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Steers—Wire Fence—Electricity.

An enthusiastic reporter on a Western paper gives a description of an encounter between cattle and an electrically charged wire fence, that deserves recognition in scientific circles. Such little details as the expense of keeping a charge of electricity running day and night through all these wires, with allowance for heavy leakage, providing a generating station, etc., are not alluded to in the article, and perhaps it is as well they are omitted. The reporter said:

"The current was turned on for the entire line, and since then, and from this on, she hums on in wonderful shape—she stands a system of practical fencing neither surpassed nor equalled by any other. It extends from a point about two miles out to a point away over in Carlson county, beyond the Southern Kansas road, and to say that the management which grasped at once its utility and had it built—to say that this management of the people who have inspected it are pleased, would be a mild expression. It is simply one of the wonders of science and is a monument to its inventor.

"On Saturday a party had a demonstration of its effectiveness. On one side of the fence stood some dozen or 15 steers, on the other, one alone. He undertook to break through and go over to the majority. He had no idea he was tackling a buzz saw when he struck that smooth wire fence. Well, sir, he jumped like he was hit at once with 40,000,000 hornets, and with his tail coiled over his back, he wheeled and only struck the ground in high places. Then the 15 made a dash to join and follow him. One by one, they rubbed the electric fence, and as they did they jumped, bawled, kicked, wheeled and sailed on as if they had urgent business at the North Pole and only had a few hours in which to make it.

"That electric fence is a stunner; it is the eighth and greatest wonder of the world. Not one of these cattle was hurt, but not one of them will go near that fence again."

Electric Light in Warfare.

Some interesting experiments have been made at Toulon to ascertain the accuracy of aim when the electric light is used for night attacks. A large gun—19 c. m. calibre—was mounted on a revolving platform, which also carried an electric projector. The mark to be hit was from three to four kilometers distant, and the only light was that of the projector. It was found that the gun could be discharged with as great rapidity and precision as was attained in daylight.

An Electric Car Warning.

The death of Mr. Joseph Stanley, president of the Broadway and Newburgh Railroad, was a lesson for the public, says the Cleveland *Plain Dealer*. Mr. Stanley lost his life through a violation of the rules which were posted up by his orders in his own cars for the protection of the passengers against just such accidents as that to which he fell a victim. By those rules it is forbidden for any one but the driver of the car to ride on the front platform of a motor car, to leave the car from the front platform, or to enter or leave the car when in motion. The president of the road did every one of those acts against which he had warned the people traveling on his line. He was riding on the front platform, and he did not wait for the car to stop. What might happen to any person doing this happened to him. His coat caught, he was thrown down and dragged by the motor car, and received injuries from which, after a few days of suffering, he died. The president of the road sacrificed his life as a convincing proof that the rules imposed by street railroad managements for the safety of the public traveling in electric cars are not unnecessary or to be safely ignored.

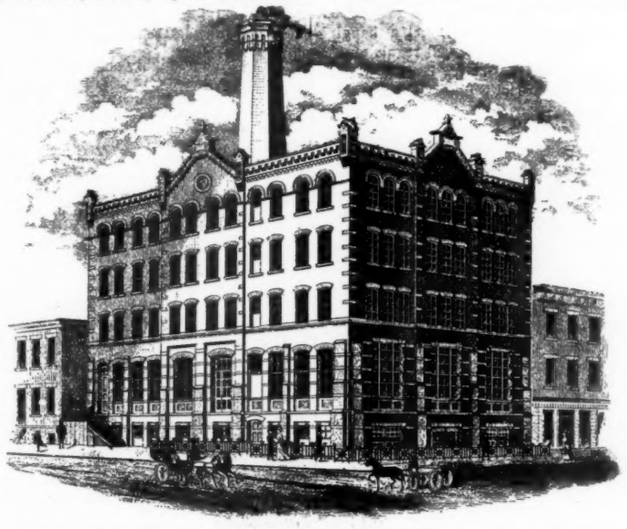

FIG. 1.—STATION B OF THE MOUNT MORRIS ELECTRIC LIGHT COMPANY, NEW YORK CITY.

The Mount Morris Electric Light Company.

DESCRIPTION AND ILLUSTRATION OF ONE OF THE COMPANY'S STATIONS—THE SCHUYLER ARC LIGHT SYSTEM USED.

In February, 1888, in a basement at 217 Washington street, this large and prosperous organization made its start in the electric lighting business. The plant consisted of a Ball high speed engine of 100 horse-power capacity, steam for which was obtained from the Steam Power company, and Schuyler dynamos to run 115 arc lights, though only 100 were operated. In July, 1888, the Harlem station at 2285 Eighth avenue, now known as "Station A," was started, with a capacity of 300 arc lights. During the occupancy of this station, the new building, which forms the subject of this article, was erected at the corner of Greenwich and Vandam streets. This is known as "Station B," and its dynamos began to operate in June, 1889. The Harlem station has been remodeled, and in September last resumed business with a capacity of 2,500 incandescent and 40 arc lights. The company furnishes current through the subways in 125th street for both arc and incandescent lamps. Cables are also laid in the subways in Broadway and in Fourteenth street; these will be in operation within a week.

The Mount Morris Electric Light Company is a corporation with a capital of $500,

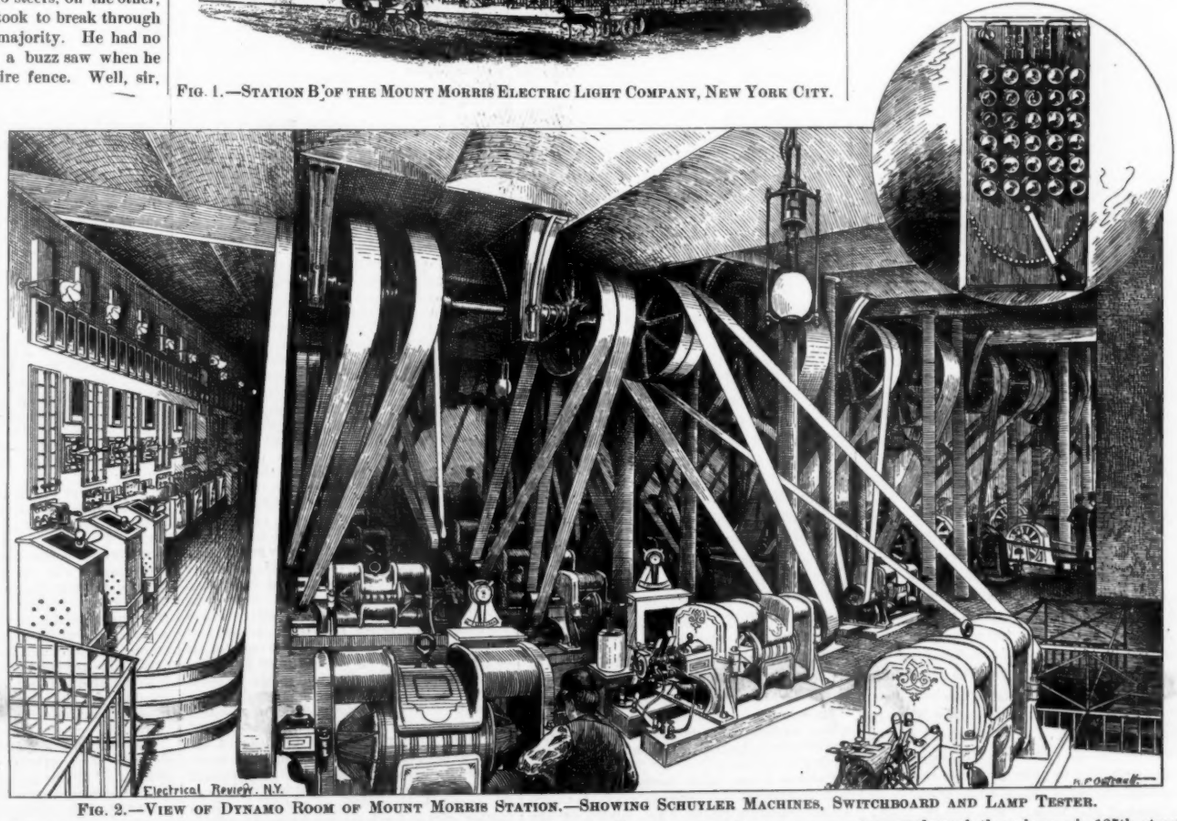

FIG. 2.—VIEW OF DYNAMO ROOM OF MOUNT MORRIS STATION.—SHOWING SCHUYLER MACHINES, SWITCHBOARD AND LAMP TESTER.

000. Edward May is president; Julius A. May, treasurer and vice-president; H. Sanderson, secretary; C. G. Young, superintendent, and C. A. Wilkinson, chief engineer.

Station B, as our illustration shows, is a handsome brick structure of modern design. It covers a piece of ground 100 feet by 67 feet.

The boiler room occupies a part of the basement. Steam is generated by five large Climax upright water tube boilers, aggregating 1,500 horse-power. These boilers are found to be very economical, both in the space they occupy and in fuel consumed, giving 10 pounds evaporation for every pound of coal. They can be fired from all sides, having four doors. The fuel is stored in vaults under the sidewalk. A view of the boiler-room is given in the upper corner of Fig. 3.

Adjoining the boiler room, at a little higher level, is the engine-room. Here are three immense Green engines, two of 500 horse-power each and one of 800 horse-power. There are also two Ball high-speed engines of 100 horse-power each. Over the cylinders of each of the large engines is a trolley for handling the heavy cylinder heads and piston rods. The drivers weigh 25 tons apiece are 20 feet in diameter, and have a 50-inch face, upon which two 24-inch belts run. The pits which the drivers run in are lined with iron, as the bottom is below tide water level. The Berryman water heater is used. Exhaust pipes are carried under the floor, and are controlled by upright valves. Blake pumps in duplicate are used, for the feeders and artesian wells are ready to be used for condensing purposes. The Locke Bros. damper regulator controls the steam output.

An ingenious system of automatic lubrication is in successful use. From a large tank on the second floor, a supply of oil is fed to every bearing by a system of pipes, which can be regulated by valves on the first floor in the dynamo room. The drips are carried through waste pipes to a filtering tank in the engine-room, where the purified oil is elevated to the service tank again by a rotary pump. A small steam pump is kept in reserve in case of accident to the rotary pump.

All the piping of the steam supply system, all injectors, pumps, etc., are in duplicate, so that no ordinary accident can cause a shut down.

THE DYNAMO ROOM.

On the first floor is the dynamo room. Here are installed 18 handsome Schuyler arc light dynamos of 50 lamps capacity each, and 25 Westinghouse incandescent dynamos, with a capacity for 30,000 lamps, when alterations now in progress are completed. There are four Westinghouse exciters, so arranged that any one can excite for the whole number. These dynamos supply with light a territory extending from Battery Place to 181st street, and when the company completes its new subways, all the wires will be carried underground. The longest circuit now in operation is 26 miles in length, carrying 47 Schuyler arc lights The system used is the full arc, 10 amperes, or 2,000 candle-power.

All the connecting wires from the dynamos to the switchboards are carried under the floor. Regulators are placed on each machine, and ammeters on the back of each regulator. This is for the convenience of the dynamo tender.

A little signal disk on top of each machine shows a red circle if the polarity of the dynamo becomes reversed. The arc switchboard was designed by the superintendent, Mr. C. G. Young, and built by the Western Electric Company. It is arranged for 30 dynamos and 45 circuits. All the connections are made on the back, so that it is impossible to get a shock while working at the front of the board. Space in the lower part of the board is occupied by safety devices and indicators protected by a glass front. A standard ammeter for calibration purposes occupies a place at the top, and over this is a 100-volt pilot or signal lamp, which is used to indicate when a line on which repairs are being made is in working order. When the lamp begins to glow, the dynamo tender waits five minutes for the lineman to get off the pole and then turns the current on to that circuit. Each terminal on the switchboard has three plugging holes, so that any change in dynamos or circuits can be made without any drop in the load. The Schuyler lightning arrester works successfully.

Munson belting and the Hill clutches and shafting are employed. The main receiving pulleys from the engine are supported independently of the line shafting by four iron columns extending from the floor of the engine room to the ceiling of the dynamo room. They are connected to the shafting by jaw clutches. This method prevents the tremendous strain from the engines from bearing directly on the shafting. A system of clutch pulleys connected to counter-shafts drives the high speed alternators.

The incandescent switchboard is very large, and to the uninitiated, very complicated. There are 10 slate feeder-boards arranged for eight dynamos. Between the feeder-boards are placed the main dynamo and field-switches, resistance box, ammeter and voltmeter, for each dynamo. Each feeder-board consists of a slate panel, a changing switch, compensated Stilwell regulator and an ammeter and voltmeter. By this arrangement of feeder-boards it is impossible to get two dynamos connected together. This company has never burned out an armature. In front of the switchboard is a pulpit having two resistance boxes for the exciter dynamos and directly opposite, on the switchboard are the exciter switches. From this point the whole system can be regulated.

The Mount Morris Company has had great success with Mr. Young's automatic safety cut-out device, which was fully described and illustrated in a recent issue of the ELECTRICAL REVIEW. There are no bare copper connections on either of the switchboards, and all connections are made on the back. The Habirshaw wire is used on all interior work, and triple-covered "K. K." wire on outside lines.

It is a remarkable fact that the Mount Morris Company has never had an accident of any kind, a fact which is in the nature of a compliment to the excellent management which is apparent in all departments of the business.

The company conducts its own supply business, and the large supply rooms and commodious offices occupy the third floor of the building.

An excellent system of central station accounts is in use, which readily show any information desired about the business. In every way the Mount Morris Electric Light Company has a model plant in Station B.

Electric Wires Run on Towers.

Colonel Flad, of St. Louis, is organizing a company under the name of the St. Louis Electric Tower Company for the purpose of carrying all electric wires overhead.

Four light iron shafts will spring from the curb at every second street intersection and meet in the center, forming miniature Eiffel towers 100 feet high. Steel cables will be suspended from tower to tower, and to these cables will be attached triangles for the support of all kinds of electric wires and a trolley for repairing them.

As the wires will be suspended in the center of streets at least 10 feet above the highest buildings, they will be out of the way of firemen working on burning buildings, and, as the wires will be supported by the triangles at short distances, they cannot fall and endanger the lives of passers-by.

Electric cars, it is claimed, can use the wires without any danger to pedestrians, and the city's electric lights can be suspended from the towers.

Colonel Flad, who invented the tower system, believes that large subways, through which repairers could walk, would be the best solution of the problem, but that at present they are impracticable on account of their great cost.

Bonds are offered in the sum of $50,000 and the city's wires will be carried free of charge. The company expects to get its profits from private companies who will use the towers.

Electricity and Storms.

C. F. DUNDERDALE.

[*Written for the* ELECTRICAL REVIEW.]

If an iron or steel table having a smooth upper surface be sprinkled with small bits of paper, and a second plate be held over it with several inches of air space between, the iron table being connected with the negative pole and the superposed plate with the positive pole of an electric generator of high potential in operation, the bits of paper will be thrown into a violent state of disturbance, as though a miniature whirlwind were in action. The drier the air and the higher the potential of the current, the more violent will be the agitation of the pieces of paper, each having a tendency to rise, but losing this tendency as the square of the distance they rise above the table.

The resistance of the atmosphere between the plates to the passage of the current of electricity through it is in direct proportion to its hygrometric status. So that the more free the air is of humidity, the more difficult the passage of the current, and the waves or vibrations of the passing current will be less frequent, producing as a consequence more violent fluctuations of electromotive force and more violent disturbance of the intervening atmospheric space. The latent, or mechanically-suspended particles of moisture, offer stepping-stones, as it were, for the passage of the current, reducing the tension of the air produced by the current, and also reducing the inequalities and vibrations of the flow.

When a cloud highly charged with static atmospheric electricity passes over the surface of the earth, the disturbance of the atmosphere forms the nucleus and motive power of whirlwinds, tornadoes and similar atmospheric phenomena. If the surface of the earth over which such a cloud passes is very dry, as in the deserts or on our western prairies, and the superincumbent atmosphere is highly attenuated by heat, the disturbance will be more violent; but should the surface be mountainous or heavily timbered, the projecting points of mountain peaks and tree tops serve as so many points of conduction, and reduce the violence of the disturbance by drawing off the cloud charge in a great measure. Once the aerial currents are started in violent motion by this condition obtaining over those portions of the earth's surface covered by the ocean, plains or deserts, under the influence of a calm condition of the superincumbent atmosphere and intense heat from the sun's rays, a cyclone, typhoon, hurricane, tornado, sirocco, whirlwind, or whatever name may be given to it by its location, is formed, and is apt to exhaust itself only after it has traveled over a considerable surface; its course being influenced largely by the configuration of the surface and the local direction of the regular air currents of the neighborhood.

It is during these violent disturbances that the air in rotation creates a vacuum, or low atmospheric pressure at the surface of the earth, and that the highest strata of colder air, charged with moisture in the frozen state, are brought down by the reaction of the upward inclining vortex, and on reaching the lower warmer strata, present the flocculent scales of frozen moisture to melt, and form rain drops. The scales losing their qualities of the Leyden jar, permit the static charge to concentrate, and acquire a potential sufficient to force its way through the resisting atmospheric media in the form of a lightning bolt. The rapid passage of this through the differently attenuated layers of atmosphere, with their varying resistances, gives effect to the peculiar, irregular form of the lightning bolt, and the vacuum thus suddenly formed in the wake of the passage of the bolt being instantly closed by the pressure of the surrounding air, produces the report known as thunder. Its violence is in a direct proportion to the potential of the bolt, and the density of the atmospheric layers through which it passes. The rapid condensation of cloud matter as it thus descends towards the surface forms the dense misty clouds seen on such occasions, and the darkness consequent to such storms. The rainfall being more or less violent, as the vacuum and reciprocal downpour of upper air strata vary. In certain portions of the earth's surface where high mountain peaks rise, in the heated and moist atmosphere found near the equator, as at Mount Martha, on the Island of Sumatra, in the Straits of Sunda, the rapidly forming clouds as they ascend are attracted to the peaks as nucleuses, where, becoming sufficiently collected to increase their combined buoyancy, they rise around the apex of the peak, and begin to condense as they reach the colder strata, producing very violent electrical storms, which completely obscure the upper half of the mountain in cloud matter, giving forth intense lightning effects with its accompaniment, thunder. This occurs each day during the heated term, and reaches its culmination at about 3 o'clock in the afternoon. The highly heated, attenuated, and consequently hygrometrically charged volumes of air over the Northern Indian Ocean and Red Sea, following the flow of the currents of the Indian Ocean along the path known as the Lagullas current, through the narrow strait formed by the Island of Madagascar and the East African Coast, meet at this point the inflow of the colder currents from the highlands of that continent and that of the upper currents over the straits, largely facilitated by the induction of the increased speed and narrowed limits of the aerial flow, bring about a very rapid condensation of the expanded moisture contained in the currents following over the surface of this ocean chute. They also cause a condition of electrical discharges of the most violent and intense character. The electrical bolts assume most brilliant tints of coloring, and the following reports of the thunder are most deafening.

The effect of vegetation on the earth's surface, is to silently draw off the static charges from the clouds, diminishing the frequency of these storms, and increasing the rainfall. In drawing off the static charge of a cloud, the flocculent scales of frozen moisture which are held apart by the charge, as exemplified in the electrified pith balls, become coalesced, and thus losing their buoyancy, descend to the lower levels of warmer strata, there becoming condensed into rain-drops of a fine misty character. These again coalesce by the law of mutual attraction, until sufficiently large, descending by gravity as rain-drops, increasing by accretion while descending through these mist strata.

Balloonists find that in ascending until they reach the clouds, and thereafter continuing, they pass through an envelope of mist gradually becoming denser until they reach a stratum of rain-forming clouds. Still ascending, the temperature meanwhile gradually falling, they pass above this line of rain-drop formation, into strata of lighter and drier clouds where the temperature is not higher than 32° Fahrenheit. Ascending further they pass entirely out of these clouds into a space that is perfectly clear, the shadows thrown by the rays of the sun, from their balloon on to the rolling sea of snowy fleece beneath, being very intense.

Ships at sea in warm latitudes, in periods of stormy weather, when the electrical alternation of the atmosphere is very high, will have formed on the boom irons at their yard-arms small coruscations of electrical flames, called by sailors "corposants." These are nothing more than electrical brushes, or the static electricity of the atmosphere collecting on the metal by concentration, and slowly diffusing itself through the higher resisting moist wood of the yard-arms, thence along to the metal slings of the yard to the mast and to the ocean.

While experimenting with a Holtz induction machine, the writer met with a peculiar phenomenon. The conductor terminals were lacquered, and, while the machine was being revolved and the static spark passing between the terminals, little beads of electricity would be driven over on to the lacquer on the ball knob of the terminal, and would remain there as long as the current was passing. These little beads could be moved about with the finger over the surface of the knob, without in the least altering their appearance.

In the vortex of a whirlwind, such as a hurricane, where the concentration of the spiral movement of the air is upwards, and where the condensation of the cloud matter is the greatest, there are found the most intense and frequent discharges of lightning, gradually diminishing towards the periphery of the storm limits.

Since the construction of the Suez Canal, and consequent culture of trees along its banks, rainfalls are of frequent occurrence, where, before the canal was built, they were almost unknown. The effect of the water was to saturate the surrounding air, increase the conduction of the static electricity of the clouds to the earth in that vicinage, and the coalescing of the floating scales of moisture of the upper strata, and to cause the consequent precipitation thereof in the form of rain.

The passage of the lightning bolt through the atmosphere converts the oxygen into the allotropic form known as ozone. This condition of oxygen seems to be similar to the cloud scales before mentioned, inasmuch as the atoms of the gas seem to be drawn into closer contiguity, in which its bulk is reduced one-third in volume. That electricity is condensing within it, or between the atoms, is evinced by its magnetic influence on a compass needle, and its oxydizing power on organic matter and hydrogen gas compounds. It is the disinfecting agent of nature, and accounts for the freedom of the atmosphere from odors immediately after an electric storm.

On retrospection, it would seem as if the element of electricity was the "automatic governor" of our aerial envelope, and without it the mechanism thereof would be suspended and chaos reign.

St. Louis, Mo.—The Commercial Telegraph Company, of St. Louis; capital, $60,000. Incorporators, H. F. Kleibacker, St. Louis; and G. M. Meyers, E. L. Martin, C. E. Hopkins, P. H. Madden, S. B. Ladd, all of Kansas City. Object, to construct and operate lines of magnetic telegraph.

Patents for All America.

THE REPORT ADOPTED BY THE INTERNATIONAL CONFERENCE, AT WASHINGTON.

The report of the Committee on Patents and Trade-Marks was under consideration by the Pan-American Conference, last week, and it was unanimously adopted. It was signed by José S. Decoud, Paraguay; Andrew Carnegie, United States, and Climaco Calderon, Colombia. The committee say:

"The person who discovers new industrial products, or invents new processes for their preparation or manufacture, or improves upon the processes already known, contributes by his discovery or invention to the development of industry and to the increase of public wealth; and has a right thereto as clear and incontrovertible under the laws of all civilized nations as that which the manufacturer has to the products of his factory or the laborer to his daily wages. Very great importance has lately attached to the emblems and devices employed by the manufacturers to distinguish the products of their factories, and by traders to distinguish the wares which they select and place upon the market, and which are commonly called manufacturers' and dealers' trade-marks. The tradesman or merchant who obtains a reputation for the superiority of articles which he distinguishes by a certain trade-mark, acquires a right to this mark, which the law should foster and protect; and it should punish those who violate this right, either by making unlawful use of, or by counterfeiting or forging a mark belonging to another."

The committee then give at some length the history of the movement, in Europe, to give international protection to literary and artistic works, patents and trade-marks, and say:

"To the recent Congress of Private International Law, of Montevideo, assembled in response to an invitation issued by the governments of the Argentine Republic and the Republic of Uruguay to the other nations of South America, is due the high honor of having been the first to acknowledge on this continent, and solemnly establish the most wholesome principles of law for the solution of disputes arising from the differences of the legislation of one country from that of another, and of establishing among these principles that of international protection of literary, artistic and industrial property. In the three treaties on literary and artistic copyright, on trade-marks and on patents, subscribed by the representatives of the Argentine Republic, Bolivia, Brazil, Chili, Paraguay, Peru and the Republic of Uruguay, who attended said congress, your committee on patents and trade-marks finds the principles set forth which, in its opinion, should be adopted throughout this continent, in order to assure and give effective protection to the rights of literary, artistic and industrial property acquired in any of the nations represented in this conference.

"In the treaties referred to, literary and artistic works, trade-marks and patent of invention, are clearly and precisely defined; in the same manner are prescribed the rights of authors and artists, proprietors of trade-marks and inventors, which the contracting powers guarantee and protect, the formalities to be observed in obtaining this protection and guarantee, the limits of said rights, and the manner in which they may be exercised. All the conflicts on these subjects which may arise from diversity of legislation between the contracting States are settled by clear and precise provisions, which are formulated with all due respect to the sovereignty and laws of each State. Thus, for instance, in respect to literary and artistic copyrights, it is provided that authors and artists shall enjoy the rights accorded them by the law of the State in which the original publication or production of their works took place; but that no State is obliged to recognize such rights for a longer time than that allowed to authors who obtain the same right in that State.

"With regard to the duration of patents, the same principle is established, and it is, moreover, provided that the duration of the patent may be limited in each State to the period prescribed by the laws of the State in which the patent was first granted, if such period be the shorter. It is also provided that questions arising on the priority of invention shall be settled according to the date of the application for the respective patents in the countries where they were granted. Finally, in all these treaties the principle is established that those who violate the rights of property therein recognized and guaranteed, can only be legally arraigned before the courts of the country in which the offence may have been committed."

The resolution recommended by the committee read as follows:

Resolved, That the Conference recommend to both those Governments of America which accepted the proposition of holding the Congress (of Montevideo), but could not participate in its deliberations, and to those not invited thereto, but who are represented in this Conference, that they give their adhesion to said treaties.

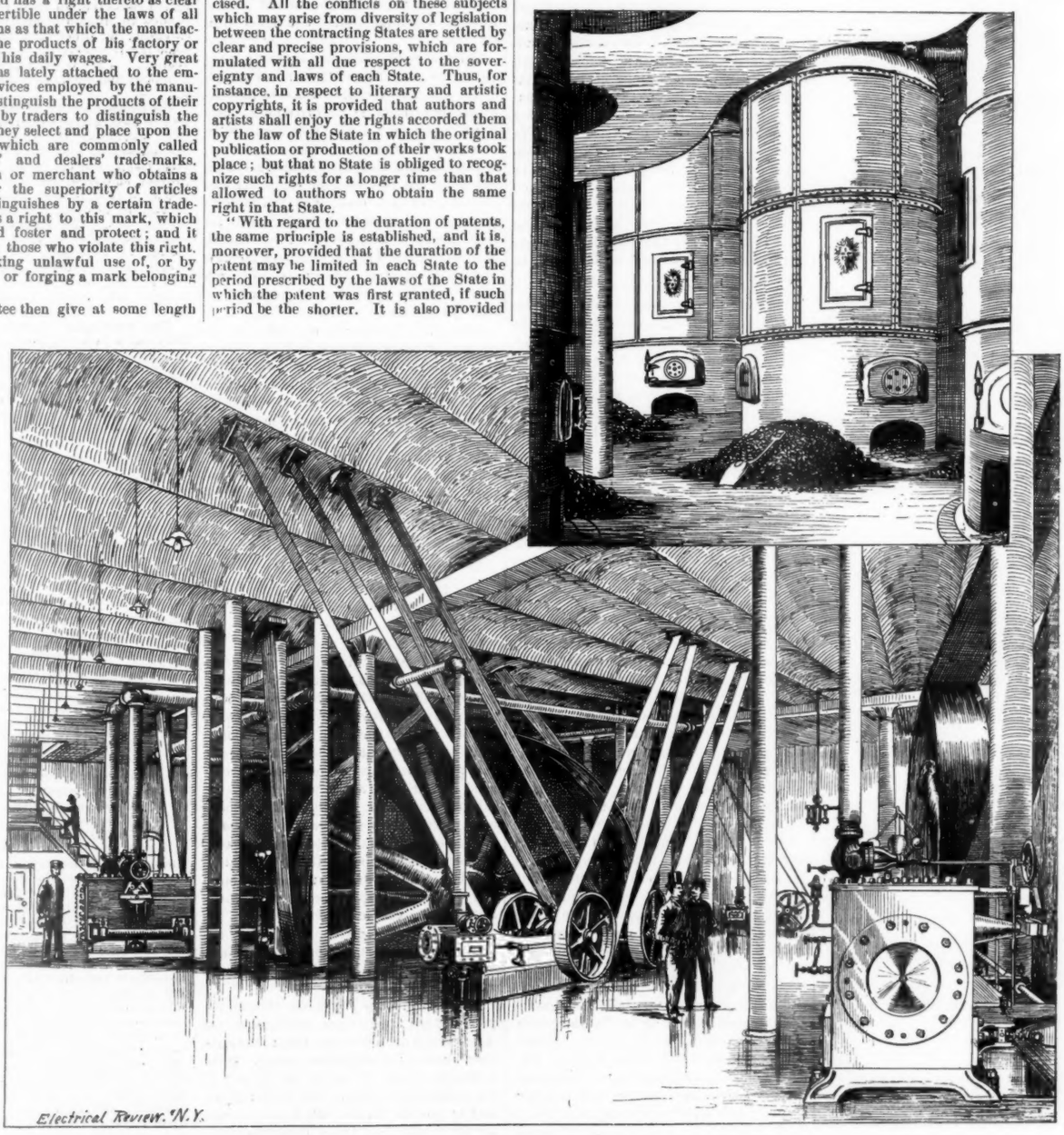

FIG. 3.—ENGINE ROOM OF MT. MORRIS ELECTRIC LIGHT COMPANY'S STATION B.—BOILER ROOM SHOWN IN UPPER CORNER.

Warrensburg, Mo. — The Warrensburg Electric Company, of Johnson County; capital, $25,000. Incorporators, James H. Christopher, James D. Eads, Geo. B. Shaw; object, to manufacture, generate and sell electricity for light, heat and motive power.

Seattle, Wash.—Articles of incorporation of the West Seattle Cable Railway have been filed by Thomas Ewing, H. G. Struve, W. E. Bailey, J. F. Eshelman and W. C. Hill, of Seattle, and Geo. W. Crayson and Homer King, of San Francisco. The objects are to operate a cable railway; to erect and maintain electric lights and telegraph and telephone wires in West Seattle; capital stock, $500,000.

California.—The Durango Electric Company has paid up $50,000 worth of its capital stock.

Springfield, Ohio.—Leetonia Electric Light and Power Company, Leetonia; increase of capital stock from $10,900 to $15,000.

Pennsylvania.—The United States Electric Lighting Company of Pennsylvania, of Philadelphia; capital stock, $1,000,000.—The Brush Electric Light Company, of Philadelphia; capital stock, $1,000,000.

Portland, Me —The Russell Electric Lamp Company, Portland, Me., has been incorporated with a capital stock of $300,000; paid in, $300,000. President, A. W. Rounds, Boston; treasurer, F. H. Carpenter, Boston.

Pittsburgh, Pa. — A charter has been granted to the Mill and Mine Electric Equipment Company, of Allegheny county. The applicants were Walter A. Giles, John S. Scully, Jay W. Carnahan, Wm. J. Burns, J. V. Patton and F. W. McKee.

Indiana.—A company with a capital stock of $25,000 is being organized at Logansport, to manufacture the Wooley electric motor. H. B. Pullman is the inventor of the machine.

Chicago, Ill.—The World's Fair Novelty and Electrical Company, at Chicago; object, to deal in novelties; capital stock, $100,000; incorporators, T. L. Johnson, Martin Burton and F. Bain.

Des Moines, Iowa.—Articles of incorporation have been filed with the Secretary of State by the Fairfield Gas and Electric Company, with a capital stock of $50,000, and to be governed by a board of directors.

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We have received an advance copy of *Industries'* "Forth Bridge Special," which contains an elaborate description of Forth bridge—the latest and greatest feature of British engineering enterprise and skill. Our esteemed contemporary, *Industries*, has all along given considerable attention to the Forth bridge, and this special number is furnished with over 120 illustrations, which portray in chronological order the progress and mode of erection. The text has been specially written by prominent members of the engineer's staff, and the description may, therefore, be accepted as authentic, as the writers are acquainted with every detail of the bridge from personal experience. It is the most interesting and comprehensive work of the kind we ever saw, and does honor to the publisher of our progressive contemporary.

In last Sunday's New York papers were reported no less than four deaths from asphyxiation by illuminating gas.

Dr. De Bausset's flying machine cannot be patented, according to the decision of Patent Commissioner Mitchell. We regret this, for the Doctor had promised us an aerial trip from New York to Chicago, in time to see the World's Fair.

There are some interesting Greek characters on another page of the REVIEW. These little things do not lead to the happiness of the printer exactly, for very few such establishments carry fonts of this type; but the REVIEW and its printers rise to the occasion at all times.

We give in another column a short account of the last meeting of the Thomson Scientific Club, of Lynn, Mass. It is a growing organization, and is destined to accomplish much good, situated as it is, in a field where its good influences will have a practical effect. The club is certainly fortunate in having Prof. Elihu Thomson interested in it. In former days it was said that the operators in a large electrical factory knew little or nothing of electricity, except what each picked up in his own part of the general work. This is now a thing of the past, and the workmen in Lynn have available a means of education for their craft which cannot be excelled.

The consulting branch of the profession of electrical engineering would seem to be very profitable across the water. It is reported that the parish of St. Pancras, London, has voted to award to their consulting engineer, Professor Robinson, C. E., a fee of $10,000, if his plans and specifications for the establishment of several central stations in the parish district are accepted; or $5,000, if they are not. Our British namesake protests against such extravagant fees, saying that it could name several eminent electricians who would have been glad to do the work for half the money, and concludes by wondering who Professor Robinson is, as he has never been heard of in the electrical world.

To secure safety to life, the railroads of this country should adopt the best means that science and intelligence of the present day can give. The terrible accident on the Lake Shore road last week, where the breaking of a fast express train and the collision of the two sections, killing seven persons and severely injuring double that number, emphasizes the fact that, in the great competition between the trunk lines, safety to life is not considered the first essential. Thousands upon thousands of dollars worth of property has been destroyed in this city and an innocent man indicted, because two deaths resulted from electric wires. Will anything be done by the public authorities, or the public to investigate and see if this recent railway accident could have been avoided? It should be done. Are there not automatic air brakes, which, on the breaking of a train, will at once shut down and stop it? Such a system is in use on the Pennsylvania system, as is also the admirable block system. If these prove so valuable in making travel safe on this line, why do not other rich railway corporations adopt them? Then, there is the induction telegraph system, an invention that we expect to see in general use on all leading railways in time.

CANCER CURED BY ELECTRICITY.

A young English physician, attached to the Chelsea hospital for women, has invented and used, it is said with success, a machine which in case of cancer, will direct a current of electricity against a diseased cell strong enough to destroy it, and at the same time will not injure a healthy cell. Those that are destroyed are said to turn into a hard substance, that remains without causing the patient any inconvenience. This is a very important application of electricity, if the account is a true one, and our American physicians should investigate it. We are compelled to express some skepticism.

ANOTHER RUSSIAN EVENT.

A remarkable story has reached us from the land of the White Czar, not, this time, of Siberian horrors, but of a wonderful, new system of telephony—that is to say, wonderful if true. We are not accustomed to look to Russia for developments in the electrical industry; in fact, to the best of our belief, the Jablockoff candle is the only electrical invention which has emanated from that curious and interesting country.

The story is as follows: At the end of last year experiments were carried out with a view to establishing telephonic communication between Moscow and St. Petersburg, by means of the ordinary telegraph line, the system of telephony employed being that of Mr. E. Grosdeff. There were present at the experiments various high officials of the Russian telegraph system and other electricians.

Three sets of telephone apparatus were set up at the Moscow central telegraph office, and at the technical school of the telegraph department, at St. Petersburg. The results obtained are said to be highly satisfactory, speaking being clear and distinct.

The peculiarity of Mr. Grosdeff's system centers in the fact that the conductor employed is of iron, whereas it has hitherto been believed impossible to use iron wire for long distance telephony. The Russian officials estimate that a line between Moscow and St. Petersburg, constructed with iron wire, would cost, at least, 20 per cent. less than if copper wire were used.

When it is taken into account that the distance between Moscow and St. Petersburg is nearly 400 miles, or about four-fifths of the distance from New York to Buffalo, the results given above are very remarkable, indeed—if true. The great omission in this interesting little tale from Russia is a detailed description of Mr. Grosdeff's "system." Until that omission is supplied, we must be excused for being a trifle skeptical as to the employment of iron wire for long distance telephony.

THE POSTAL TELEGRAPH CREED.

The fundamental article in the Wanamaker telegraph creed may be summed up as follows:

Out of the discussion and agitation of the telegraph question before Congress, during the past 25 years, several facts have been crystalized. First. The telegraph business, as a whole, is very profitable. Second. There is a general demand for the establishment of a telegraph service, either on the part of the government, or under government patronage, to act as a check upon the existing companies. Third. This demand, however, has not heretofore been so great as to overcome the serious objections to a government system, first, in the appropriation of a large sum of money sufficient to build and equip telegraph lines; second, the addition of a vast army of employés to the government civil service; and, third, the placing of so important a means of communication under the virtual control of the ruling political party.

The bill which the Postmaster-General has presented and argued upon, he thinks, should satisfy the general demand, and, at the same time, answer the objections named. It involves, he states, no outlay on the part of the government, except to the extent necessary to provide for the added mail service, for which the Post Office Department will get its regular mail postage. It leaves telegraph employés in the employ of private corporations, does not add to the number of government employés, and it does not necessarily give to the government or any of its departments any sort of espionage or supervision over the affairs of those who use the telegraph.

There may yet be some very interesting developments in this government telegraph idea.

Captain H. R. Garden, a prominent member of the Electric Club, and ex-member of its board of managers, has just been unanimously elected president of the Southern Society, of this city.

CORRESPONDENCE.

Electrical Happenings in Washington, Albany, Boston, Chicago and the South.

OUR WASHINGTON LETTER.

The Gutta-Percha Patent. — The heirs of Geo. B. Simpson are again pressing their claims before Congress. They ask that patent No. 65,019, which expired May 21, 1884, be extended for seven years. This patent covers broadly the use of gutta-percha for insulating electric wires. The invention was made in 1847, but, owing to the stupidity of the Patent Office and the poverty of the inventor, the patent was not issued till 20 years later. Meanwhile, gutta-percha covered wire had come into general use, and the patent was vigorously contested by infringers. It was finally sustained, and rights to operate under it were paid for. The owners of the patent claim that all their receipts were expended in litigation, and they now ask the extension in order that they may obtain some fair remuneration for the valuable invention. The Western Union Telegraph Company and other interested parties oppose it.

The Commonwealth of Massachusetts has sent a memorial to Congress urging legislation instructing the Interstate Commerce Commission to consider whether some uniform means may not be adopted to save life, prevent suffering, and add to the comfort and security of railway passengers and employés, in heating, lighting and operating railway cars. This measure is intended to secure the use of an efficient and uniform system of automatic couplers and train brakes, and the safest systems of heating and lighting for all railroads in the United States. The Senate Committee on Commerce has the matter under consideration.

The Washington Electric Lighting Company wants a charter from Congress with the privilege of running overhead and underground wires to supply public and private lights in the District of Columbia. The proposed capital is $500,000. J. George Gardner, the agent for the Loomis system, is the active promoter, and Samuel M. Bryan is the leading incorporator of the company.

The Postal Telegraph Hearing was continued on the 4th inst., at Washington, when Mr. D. H. Bates appeared as the representative of a company of men of large means and influence, who, he stated, are prepared to build lines and enter into a contract with the government, to establish telegraphic service at all the free delivery post offices, provided the rates to be charged are made satisfactory. He expressed the opinion that fair and satisfactory rates would be:

For all business within a State, or within a distance of 500 miles	15c. for 10 wds.	
For all distances over 500 miles and east of the Mississippi River, including St. Louis, New Orleans and other large cities	25 or 30c.	"
For all distances over 500 miles and west of the Mississippi	25 or 30c.	"
For all business between the 85th and 100th parallels	25 or 30c.	"
Maximum rate	50c.	"

These amounts are to be the total charge to customers, and include an allowance of two cents per message to the government for the collection and delivery of messages and for office rent. The company proposes to build, equip and operate the lines under a 10-year contract, and would require no guarantee as to the amount of business to be done. All the business done under this part of the plan explained by Mr. Bates, is to be under the control and management of the Post Office Department. In addition to this kind of service, the proposed corporation would be at liberty to do any other business it could get, through the agency of clerks, messengers and other employés of its own, and at rates to be fixed by itself. This is substantially the plan indicated by the Postmaster-General, except that Mr. Bates believes that the business will require the services of experienced operators, and that post office employés cannot readily "learn the ticks." Mr. Bates brought the results of his many years' service in the Western Union Company, and in rival companies, to bear upon assertions made by President Green, and submitted statements to disprove them. He insisted that the facts demonstrated that the telegraph business as now conducted, is exceedingly profitable, and that it is perfectly feasible and practicable to carry it on according to his plan at much lower rates. He characterized Dr. Green's statement that the B. & O. Telegraph ruined itself and nearly wrecked the B. & O. Railroad Company as absurd, and produced official figures to show that it paid its own way and made a small profit.

Mr. P. B. Delany wants the government to investigate his system of multiplex telegraphy, with a view to its use on the postal lines if found to be useful, and a bill authorizing such investigation by the Postmaster-General is pending in the House of Representatives.

The Inter-Ocean Telegraph Company is the title of the proposed corporation for doing the postal telegraph business, with D. H.

Bates as president. It is chartered under the general laws of Virginia, and proposes to construct, maintain and operate, "*telegraph and telephone lines.*" The incorporators are several Washington attorneys, whose connection with the company is merely formal. The air is full of rumors connecting the Postal Telegraph Company, the Telephone Company, high government officials and prominent capitalists, with the undertaking, but it is hardly worth while to publish them, as the facts will soon be made public.

The President of the Western Union Telegraph Company, after recovering from his attack of high temper, during which he charged the congressional committee with being "coached" by Mr. Wanamaker, sent a very polite letter of explanation, withdrawing the uncomplimentary term, and requesting that "urging the committee" be substituted. G. C. M.

Washington, D. C., March 8.

SOUTHERN ELECTRICAL NEWS.

Personal.—Mr. D. I. Carson, of New York City, general superintendent Southern Bell Telegraph and Telephone Company, is in Atlanta on an official visit.—Mr. J. D. Easterlin, district superintendent Southern Bell Telegraph and Telephone Company, of Macon, Ga., was in Atlanta March 3d.—Mr. D. Doren, general superintendent of construction Western Union Telegraph Company, is in Atlanta, inspecting his company's line.—Mr. J. Merrihew, general superintendent Western Union Telegraph Company, of New York, who has been for some time past in Florida, is making a short stay in Atlanta.

The Thomson-Houston Company, of Atlanta, are placing a new 1,000-light alternating machine in their works. The Lookout Mountain Hotel, of Chattanooga, Tenn., has been supplied with a 30-light arc machine, Thomson-Houston system.

Mr. Morris Slattery, agent for the Edison Company in Atlanta, has just returned from a business trip in the South, and reports business good, with increased orders.

The Atlanta Electric Club.—The second meeting for the purpose of organizing an Electric Club, was held on the night of February 12th, at the offices of the Georgia Phonograph Company. A draft of the constitution and by-laws was submitted; and after some discussion, was adopted. A short letter from the Chicago Electric Club was read with interest.

The following nominations were made for officers of the Club: Mr. J. M. Stephens, manager Western Union Telegraph Company for president; Mr. Howard E. W. Palmer, general manager southern office Thomson-Houston Electric Light Company, first vice-president; Mr. W. T. Gentry, manager Southern Bell Telephone Company, Atlanta, second vice-president; Mr. F. E. Clarkson, superintendent Georgia Phonograph Company, treasurer; Mr. H. H. Jackson, assistant manager Southern Bell Telephone Company, Atlanta, secretary.

Mr. F. E. Clarkson, Mr. G. H. Wade, superintendent Georgia Electric Light Company; Mr. W. T. Gentry, Mr. W. J. Cole, district superintendent Southern Bell Telephone Company; Mr. J. M. Hollis, manager Gate City Supply and Electrical Construction Company, board of managers.

Mr. L. D. Nelson, superintendent Fulton County Electric Street Railroad; Mr. G. L. Thompson, Thomson-Houston Electric Light Company, Mr. George W. Moore, superintendent Edison Light, committee on membership.

The next meeting of the Club will be held at the parlors of the Atlanta Zouaves, March 11, at 8 P. M., for the purpose of electing officers, receiving new members and deciding upon suitable quarters for club rooms. The membership list has increased to 53, and much interest and enthusiasm has been shown in the movement. The club will be known as the Atlanta Electric Club. F.E.C.

Atlanta, Ga., March 4, 1890.

OUR ALBANY LETTER.

The Telephone-Electric Railway Suit.—ALBANY, March 3d: In the general term here to-day, before Justices Learned and Landon, the case of the Hudson River Telephone Company *vs.* the Watervliet Turnpike and Railroad Company, came up. The telephone company had sued the railroad to compel it to use the double trolley system with its electric motors, on the ground that the single trolley system seriously interfered with the telephone wires. As a result of the suit, the railroad was enjoined from using the motors for 30 days, during which the telephone company was to fit its instruments with metallic circuits, on the ground that this would be cheaper than to have the railroad put in double trolleys. At the same time the railroad was ordered to give a bond covering its proper liability for the cost of the metallic circuits. The question to-day was on the amount of the bond. D. Cady Herrick, on behalf of the telephone company, read an affidavit of Manager Uline to the effect that the introduction of the metallic circuit for the 1,400 telephones in the system would necessitate a great loss of business and corresponding revenue, while the change was being effected, the restringing and doubling of all wires in use, new cables and new switchboards, besides entailing other losses to a considerable amount. A new switchboard alone to meet the change would cost $18,000.

Mr. Herrick insisted under the circumstances the bond be $125,000, as that would be all the plaintiff would have to rely on in recovering damages, as the road itself was practically valueless with the indebtedness against it.

Mr. Hun, on behalf of the railroad company, said that it was unjust to assume that the entire telephone system in the city must be changed, and read an affidavit of William H. Cull, who for seven years was superintendent of construction of the Hudson River Telephone Company, up to January 31, 1890. This set forth that he was familiar with the construction of the telephone system, and thought that the amount for the whole system would be $24,470, while that portion of the telephone system along Broadway, which would be affected, could be changed for $6,000.

Mr. Hun also read an affidavit of Wm. I. Hopkins, of Boston, formerly connected with the American Bell Telephone Company, who also estimated the cost of a metallic circuit along the line of Broadway, with a switchboard, at $6,000. Another affidavit from Electrician Courtright to the same effect was read.

$50,000 the Bond —After some time spent in consultation, the judges decided to fix the bond at $50,000, and to continue the injunction for 30 days from March 4th, to enable the telephone company to put in the metallic circuit. The order thus settled, including the agreed upon reference to Isaac Lawson, was duly communicated to counsel, and will be entered up.

Telephone Rates.—Assemblyman Currier has introduced a bill fixing the charges for telephones in towns and villages having a population of 10,000 or over at not to exceed $2.75 a month.

March 6.—Assemblyman Coons introduced a bill to regulate the delivery of messages by telegraph companies. It provides that no telegraph company shall make any charge for delivery of messages within the limits of any city or village in which its office is located. In any district, not in a city or village, it may have the right to charge for such delivery at the rate of 25 cents for each mile or fraction thereof.

March 7.—The annual supply bill, reported to-day, appropriates $6,000 for the Attorney-General for the expenses of the Kemmler electrical execution case.

Albany, N. Y., March 8. H. L.

OUR BOSTON LETTER.

Fuse Wire Tests.—During the past week some very complete tests of fuse wire and fuse metal have been held at the Boston Electric Light Company's station, under the supervision of the board of fire underwriters.

The Massachusetts Electrical Engineering Company report business very brisk. Some tests of novel forms of dynamos and motors have just been completed.

The Tripp Manufacturing Company have just moved into elegant offices in the N. Y. & N. E. R. R. building, at 180 Summer street. The offices are on the fifth floor, light and airy, and, furnished, as they are, in antique oak, make a very handsome appearance. This firm handles an anti-friction journal bearing, and an asbestos packing, both of which are meeting with great success in the electric field.

New Station Opened.—The Suburban Light and Power Company opened their new station on Norfolk avenue, off Hampden street, Boston, last week. Treasurer A. C. Burrage did the honors of the evening, and, assisted by the officials of the company, showed the guests the new Westinghouse arc system of lighting. The city was represented by Mayor Hart and members of the city government. There were also present President Clapp, of the Suburban Company; Councilor Tufts, a director; P. H. Alexander, of the Westinghouse Company, and others. The building used as a station was formerly occupied by the Globe Nail Company as a rolling mill, is 78 feet wide, 170 feet long and 70 feet high, and built of brick. The engine is a 700 horse-power affair, and there are two boilers of 100 horse-power each. Two electrical machines of 65-light power each do the work of illumination. The lamps are of the arc pattern, and the carbon is wide and flat, working with an alternating current. The carbons are claimed to be superior to the round ones, for the reason that they will last 48 hours, while the ordinary burn a much shorter time. The light appeared to be of a good character and brilliancy, and burned very steadily.

Mr. Howard of the "C. & C." Motor Company was a New York visitor last week.

New Installations.—The Thomson-Houston Company are putting in plants in the Portland and Metropolitan lines of steamers, and are also installing a 1,800-light plant in the new Boston Shoe and Leather Exchange. All these plants will use the Evans friction system for driving their dynamos.

Boston Electric Club.—On Monday evening the members of the Club will dine at Young's Hotel. The post-prandial exercises will include a discussion on the Transmission of Electrical Energy, in which Prof. Elihu Thomson and others are expected to take part. Dinner will be served at 7 o'clock, so as to give plenty of time for the discussion.

Boston, March 10th. S. L. C.

OUR CHICAGO LETTER.

Electric Motor Factory.—There is a report current that Henry Villard is organizing a large electric company for the manufacture of street car motors, motors for mining machinery, and the supply of every thing demanded in the business. It is the intention, it is said, to erect the factory near Minneapolis and utilize water power.

The Hawkeye Electric Manufacturing Company, Davenport, Iowa, has lately closed contracts to build and equip a motor circuit, especially for stationary motors, for the Capital City Gas Light Company, of Des Moines, Iowa. The first installation will give them a capacity of 100 horse-power. The above company has also closed a contract and commenced the work of putting in a 5,000-light station at Muscatine, Iowa.

The Regular Meeting of the Chicago Electric Club was held last Monday evening, March 3d. Dr. Paul Schoop, of Zurich, Switzerland, presented a paper entitled "A Theory of Accumulators." The Doctor, not understanding the English language very thoroughly, requested that C. C. Haskins read the paper. The attendance was good and the paper very interesting.

Personal.—F. L. Shallenberger, Pittsburgh, Pa., F. Kerr, Pittsburgh, Pa., and Ned Fox, representing the Phoenix Glass Company, New York, were visitors at the Electric Club during the past week. W. H. McKinlock, of the Central Electric Company returned Tuesday from a trip in the sunny South.

The Chicago Electric Club is the recipient of a picture from President F. G. Beach, that of the National Telephone Association, at Minnehaha Falls, Minn., Sept. 12, 1889.

Chicago, March 8, 1890. D. B. D.

The Thomson Scientific Club, of Lynn, Mass.

The first number of the transactions of this society has been distributed, the larger part of the pamphlet being taken up with a paper by Professor Elihu Thomson, on "What is Electricity?"

The club is a young association whose members are chiefly those connected with the electrical and other departments in the works of the Thomson-Houston Electric Company and the Thomson Electric Welding Company, in Lynn. The club aims to furnish at intervals instruction and entertainment to its members in the form of lectures, papers and talks, on scientific and technical subjects, besides offering the advantages of a club reading room.

This lecture or talk was given by Professor Thomson and reported stenographically. The style is, therefore, conversational in its character, and while printed matter conveys the ideas touched upon by Professor Thomson, there can, of course, be no reproduction in this form of the manner of statement with the inflections and emphasis which often constitute a large part of the interest and charm which such a talk possesses. Many of the experimental illustrations were of the most decidedly novel character, some of them having been expressly worked out for the lecture.

After some humorous cracks at the electric belt, brush and corset quacks, and the "Electricity is Life" man, Professor Thomson enumerated some of the benefits which had accrued to science in general owing to the use of electricity, and proceeded as follows: Franklin's experiments upon the nature of electricity were taken up briefly, and then the lecturer stated that he would endeavor to show that we can go a little distance in proving the identity of light with electricity. The actual experimental proofs of this have been developed only within the last year or two. It was Faraday, who, for the first time, seemed to have the idea pretty clearly, although others undoubtedly had glimmerings of the same idea. Clerk Maxwell worked out this fact. He worked at the problem mathematically, and came to the conclusion that the vibrations of light were electric waves, that what we call undulations of light were electric waves.

Mr. T. McCoubray, formerly with the Baxter Motor Company, is now connected with the Crocker-Wheeler Electric Motor Company as secretary and general agent. Mr. McCoubray is an experienced electric motor man, and will undoubtedly prove a valuable addition to the staff of Messrs. Crocker and Wheeler.

Mr. A. D. Newton, the energetic and affable manager of the Eddy Electric Motor Company, paid the metropolis a visit last week in the interest of his company. The Eddy Company is one of the recognized successes in the electric motor field, and this may largely be attributed to the wide-awake manager.

Electric Club Volts and Amperes.

The excellence of the papers read before the Electric Club is being commented on most favorably.

Meals are now served at the Club, from 12.30 P. M. to 12.30 A. M. There are a number of members living in that part of the city who now lunch at the Club each day.

The official staff of the "C. & C." Electric Motor Company dined together at the Club, Wednesday evening of last week. As usual, Steward Hummel covered himself with honor in preparing and serving the dinner.

That great American traveler and telephonist, Thomas Bridgeport Doolittle, was a recent visitor at the Club on his return from a trip to San Francisco. There were many there to welcome the returned one, and they listened with bated breath and great interest as he told of the adventures and narrow escapes from prairie fires, herds of buffalos and wild horses, and bloodthirsty Indians, to say nothing of the wide-batted cowboys, which had been encountered in crossing the plains.

The great risk to all electrical travelers, in passing through prohibition Kansas, had fortunately been thought of, and provisions made to cover the case. The climate of California suited the telephone man from the East. He could pick oranges one hour, and the next, after a short railway ride, could cool his heated brow in the beautiful snow. The telephone business of the Western coast was found to be very good, which was to be expected, as it is under the able management of Colonel John I. Sabin. The royal entertainment and hospitable treatment accorded the Eastern visitors by Mr. Sabin—General Sherwin, auditor of the American Bell Telephone Company, was with the party—were features of the visit that will never be forgotten.

Important Decision by Patent Commissioner Mitchell.

A decision was rendered a few days ago by the Commissioner of Patents in an interference case relating to a patent on a system of electric lighting claimed by the Westinghouse Electric Company and the Fort Wayne Jenney Electric Company. The decision is in favor of the Westinghouse Company. About two years ago the Evansville Electric Light Company, of Evansville, Ind., was sued by the Fort Wayne Company, in the United States Circuit Court at Indianapolis, for using a certain system of electric lighting which the Fort Wayne Company claimed to exclusively own under a patent of M. M. M. Slattery. The Evansville Company uses the Westinghouse alternating current apparatus, and for that reason the suit was in reality against the Westinghouse Company. The Westinghouse Company claimed that the right to the patent ought, by reason of priority of invention by Wm. Stanley, Jr., to belong to them, and the consequence was that the interference proceedings were at once entered in the Washington Patent Office, with the above result. The case has occupied the lawyers for over a year and a half.

The patent is, in substance, for coupling converters in parallel or multiple arc in circuit with an alternating current dynamo, and so constructing and proportioning the converter that the system is entirely automatic in its regulation through the reaction of the secondary currents upon the flow of current in the primary coils. The interference was nominally between Slattery, of the Fort Wayne Company, and Stanley, of the Westinghouse.

Annual Meeting of the New York and New Jersey Telephone Company.

The stockholders of the above company met on Saturday of last week, and elected the following named gentlemen directors for the ensuing year: Charles F. Cutler, Alexander Cameron, Theo. N. Vail, Joseph P. Davis, Morris F. Tyler, Chas. A. Nichols, Hugh Kinnard, Samuel Klotz, W. D. Sargent.

The Domestic Telephone Company, of Newark, was incorporated with the N. Y. and N. J. Company, and also the Staten Island Company, $135,000 worth of new stock being issued to pay for the latter company.

The company was authorized to issue bonds in the sum of $1,500,000, the proceeds of which were to be used in the purchase of real estate in Brooklyn, Newark and Paterson, and for underground work in the two cities first named.

The general business of the company was found to be in a very satisfactory condition. The directors will meet and elect officers at an early day.

Telephone News.

⁂ An electric indicator has been placed by the city of Boston, in the pumping station on Condor street, to show, at all times, the height of water in the tank lately placed on Breed's Hill.

⁂ The Delaware and Atlantic Telephone Company have completed arrangements for connecting Norristown with the Eastern Pennsylvania territory, and Norristown subscribers can now secure communication through this exchange with Allentown, Bethlehem and other points in Eastern Pennsylvania.

⁂ Telephone communication, which had been interrupted between San Francisco and Santa Rosa, Cal., and other points, by reason of the breaking of the submarine cable, was resumed a few days ago by means of a new cable, which was successfully laid across the straits between Fort Point and Lime Point.

⁂ The New York and New Jersey Telephone Company, through Major Samuel Klotz, has purchased the property at 158 and 160 Market street, Newark, N. J. The price paid was $70,000. It is the intention of the company to erect on the site a six-story building, which will be occupied as their main office.

⁂ The Edison United Phonograph Company have filed articles of incorporation in the county clerk's office. The incorporators are S. B. Eaton, A. O. Tate and Edward J. Kavanagh. The plant will be located in Orange. The capital stock is $1,000,000, and the company will begin business with $10,000.

⁂ The New England Telephone Company has contracted with the Western Electric Company, of New York, for a new multiple switchboard, which will be installed in the company's new building on the corner of Milk and Oliver streets, Boston. The new switchboard will be of the standard type, with all the latest improvements, which are of but a detail nature. It will be one of the best in the country, and will be equalled in size only by the one used in New York city. The capacity will be about 6,000 wires, but will be started with about 4,000 in operation.

⁂ The new telephone connections between Bethlehem and Norristown, Pa., are to be made at once. Manager Charles J. Smith, of the Bethlehem Exchange, has started a gang of linemen at work extending the Bethlehem line from Coopersburg to Quakertown, a distance of six miles, where the extended Norristown line will be met. The work is to be rushed to completion. At Norristown the line will connect with the Delaware and Atlantic system, and thus access to the Philadelphia district will be gained. Within a month it is expected there will be direct telephone communication to Norristown and Philadelphia.

⁂ In ten large cities of this country the telephone rates are as follows: Boston, banks and express rate, $200; business, $96 to $120; New York, there are three rates, legal and express, $210 a year; business, $150 to $180; residence, $75 to $100; Philadelphia, business, $120; residence, $100; Chicago, business, $100 to $125; St. Louis, business, $100; Cincinnati, business, 72 to $100; residence, $72 to $96; New Orleans, $96, and Denver, $80. Kansas City business is $72; residence, $60. In Kansas City the first rate is for any point within a radius of three-quarters of a mile of the telephone exchange, and for each quarter of a mile beyond this limit there is an extra charge of $6 a year. In New Orleans the rate system is different than in other cities. The rate is $60 a year for using the Bell telephone, and each subscriber has to pay the local company five cents for each connection made.

Telephonic Specific Inductive Capacity.

BY F. H. SAFFORD AND G. U. G. HOLMAN.

In a paper on the Construction of Telephone Circuits, read before the American Academy, on the 15th of June, 1887, by the Electrician of the American Bell Telephone Company, Dr. Jacques, it was pointed out "that the readiness with which telephonic conversation may be carried on over any circuit, whether made up of cables or pole lines, or both, depends,

"1. On the total electrical resistance of the circuit joining together the two stations.

"2. On the total electrostatic capacity of this circuit."

And the general rule was laid down:

"No matter what may be the distance between two points, good business conversation may be carried on between them, provided they be connected by a pole line or cable, or both, the product of whose total resistance by its total capacity is less than 2,000, if transmitters of the Blake type be used, and less than 4,500 if transmitters of the Hunnings type be used."

It is evident, therefore, that in the construction of a telephone line it is desirable to reduce both the *resistance* and the *capacity* to a minimum.

In a pole line, since the wire is suspended high above the earth, the capacity is always small, and the resistance is the factor that we must try to keep down.

In cable lines, however, where the conductor is necessarily brought near to other conductors, or a metal shield, or the earth, the capacity becomes quite an important factor to be respected.

In lines made up, as is most generally the case, of a comparatively short section of cable and a larger section of iron pole wire, the capacity of the cable becomes pre-eminently the factor to be respected; for, since the limit of conversation is here determined by the product of the capacity of the cable, and the resistance of the whole line, a small percentage of saving in the capacity of the cable gives an enormous gain in the readiness with which conversation may be carried on over the line.

It becomes of vital importance, therefore, to choose an insulating material for telephone cables of low specific inductive capacity.

We have accordingly measured the electrostatic capacity of a considerable number of substances used for insulating wires in cables, and, since the specific inductive capacity for the same insulator is very different for telephone currents from what it is for telegraph currents, because the charge and discharge take place so much more frequently, we have adopted a method and apparatus in which currents of telephonic frequency are used.

This apparatus is a Gordon induction balance (see Gordon's Electricity and Magnetism, p. 110), in which the substances were charged and discharged by currents from an induction coil, and the balance was observed with a telephone instead of an electrometer.

With this apparatus, we measured the specific inductive capacity of a considerable number of insulating materials, and each when subjected to various rates of charge.

We found that the capacity varied very materially with the rate of charge, some substances increasing and others decreasing, but no general rule was evolved.

We found that measurements of the capacities of telephone cables made by the ordinary galvanometric measurements gave no indications of the comparative merits of these cables for telephonic work.

Finally, we made an accurate series of measurements of the specific inductive capacity of the following substances, when submitted to actual telephone currents. The values might perhaps be called the "telephonic specific inductive capacity," leaving the expression "telegraphic specific inductive capacity" to indicate values measured in the old-fashioned way.

TABLE OF SPECIFIC INDUCTIVE CAPACITIES, MEASURED BY TELEPHONE CURRENTS.

Petroleum (Brooks Cable)	1.6
Solid paraffine	2.0
Cotton saturated with paraffine in vacuum (Faraday Cable)	2.0
Cotton boiled in paraffine (Patterson Cable)	2.6
India-rubber	3.7
Artificial gutta-percha (Gwynn)	3.9
Gutta-percha	4.2
Glass	4.6
Water	6.3

An inspection of this table shows that, so far as capacity is concerned, petroleum is the best substance to be used, and doubtless this would be the case were it possible to keep it free from water; but water, we see from the table, has a specific inductive capacity of 6.3, so that its presence in the petroleum raises the capacity from the lowest to the highest in the list.

This observation is borne out by actual experience with "Brooks" cables in telephony. When new, and the petroleum dry, it works excellently; but as water finds its way in, the cable rapidly loses its efficiency for telephonic work.

This action of the water is quite different from its action as a *conductor* to produce leakage, for the loss of electricity due to leakage in a Brooks cable that has lost its efficiency from the presence of moisture is entirely insufficient to account for the deterioration.

Next to petroleum, solid paraffine is seen to be the best substance to use; but on account of mechanical difficulties it has never been found practicable to coat wires directly with solid paraffine.

If the wires are wound with cotton and then boiled in paraffine, as they are in making "Patterson" cables, the specific inductive capacity is raised to 2.6, an increase of 30 per cent., which we have seen is a very great detriment.

If, however, the wires are wound with cotton, and the air and moisture removed by the aid of heat and a vacuum, and they are then boiled in paraffine, from which the air and moisture have also been removed by heat and vacuum, the specific inductive capacity again falls to 2.0, which is the same as that of solid paraffine. This is the process used in preparing the "Faraday" cable.

Underground Telephone Work in Boston.

Col. J. N. Keller, of the New England Telephone Company, is, like Brer Rabbit, "layin' low" and waiting for spring to come. At that time the Colonel will set the wheels a-moving and put into operation the plans for new subways in Boston, which he has been formulating this winter. The company now has about 14 miles of underground wire in Boston, and hopes to largely increase the number. The manholes are remarkably free from gas, which speaks well for the construction work done by the gas companies.

OUR LONDON LETTER.

ELECTRICAL NEWS FROM ABROAD.

Electric Traction.—The late meeting of the North Metropolitan Tramways Company, Limited, was full of hopeful augury for the early introduction of the improved method of traction, the experiments in which on the Barking Road have been attended with such remarkable success, as to cost a saving of, at the very least ¾*d.* per mile, has been ascertained, and it is believed there would be an economy of about 20 per cent. Hitherto, a kind of license has been obtained from the Board of Trade, but it is now intended to go to Parliament for power to increase the capital of the company, and in the same bill to apply to be permitted to use electric or other mechanical traction over such portions of their system as may be considered advisable. The London Tramway Company, Limited, at their meeting, came to a similar resolution in regard to applying for a bill to use electric or any other power which may be discovered in the driving or drawing of their cars.

Subway Companies.—The directors of the City of London and Southwark Subway, are proposing to alter the name of the company to the City and South of London Railway Company, as being in greater harmony with the present nature and object of the undertaking, and a bill has been deposited in Parliament for power to extend the line from the present authorized terminus at Stockwell, to about a mile further, "The Plough," an inn of long standing and the great center of traffic in that district of London.

Electrical Engineers' Institution.—The journal of the institution, which has just been issued, gives the report of the council for the last year, and the award of annual premiums. The institution premium, £10 in value, is given to W. M. Mordey, member, for paper "Alternate Current Working," the £5 "Paris Electrical Exhibition" premium to Dr. Oliver Lodge, F.R.S., for paper "Lightning, Lightning Conductors and Lightning Protectors," the Fahie premium, valued at £5, to A. E. Kennelly, associate, for "Certain Phenomena Connected with Imperfect Earth in Telegraph Circuits." With regard to election of members to the council and with the desire of effecting a gradual, but complete change in its composition, the suggestion of Professor Forbes has been adopted that at least two of the retiring members of the council each year, should be those who have served the longest time. Professor Forbes and Doctor Fleming, have therefore retired and also Mr. Stroh, who pressed his resignation until it was accepted.

London Chamber of Commerce.—The Metropolitan Electric Supply Company was among the companies elected as members at the January council meeting of the London Chamber of Commerce.

Professor Rucker at the London Institution.—The nature and action of electrical forces was the subject of a lecture given by Professor Rucker to the members of the institution, in Finsbury Circus, last week. There was a big attendance, and most hearty applause greeted the numerous experiments by which the lecture was illustrated.

The Houses of Parliament.—The new installation at the House of Commons, by the Westminster Electric Supply Company, which was started on the opening of Parliament, has proved a great success. At present there is a temporary station in the yard at back, but a permanent station is being erected, and the House of Commons will then be connected with the street mains.

Doctor Siemens.—It is announced that Dr. Werner von Siemens, who lately retired from business, is now engaged in writing his autobiography, which will contain many interesting details of the development of the Siemens and Halske business.

Messrs. Woodhouse & Rawson, Limited.—This firm are under contract to wire the works and offices of the Hansard Publishing Union, Lincoln's Inn Fields, the current for which will be supplied from the Sardinia street station of the Metropolitan Supply Company. Two 30 ampere arc lamps are to be installed, in addition to glow lamps, to help in the Vanoni process of photo-engraving.

The India Rubber, Gutta-Percha and Telegraph Works Company, Limited.—This most successful company held its twenty-sixth ordinary general meeting last Friday afternoon. The net profit for the past year was shown to be £57,748 9*s.* 1*d.*, and out of this sum a dividend was recommended of 10*s.* per share, free of income tax, and making, with interim dividend paid last July, a total interest for the year of 10 per cent., and a sum of £41,236 6*s.* 8*d.* was carried forward. The chairman was glad to be able to say that the general business of the company had been well maintained, and that the loss through the strike of their work-people was but small, as other means had been found available for the execution of orders.

Electric Fairy Lamps for Theatres.—Although small electric fairy lamps have been very successfully used in ballets, considerable difficulty has been experienced in the disposing of the small batteries and accumulators, which were by no means unlikely to spill over and damage not merely the clothes, but the dancers themselves. An experiment is now being tried to do away with the batteries, and to supply current on the alternating system. A primary is led to coils below the stage, and in the heels of the dancers' shoes a small secondary coil is fitted—their dancing or standing over the primary, causes the lamps to flash up with most striking effect. In the two excellent ballets at the Empire Theatre, in Leicester Square, "The Paris Exhibition" and "Dream of Wealth," which are attended by enthusiastic crowds every night, much of the success of the spectacle is due to the electric lighting arrangements of Mr. Harry South, of 10 and 12 Garrick street, W. C.

Incandescence Without Vacuum.—I learn that a system of electric lighting by incandescent lamps, in the ordinary air, without a vacuum, is now being worked out by the Société Française d'Eclairage Electrique.

Messrs. J. A. McMullen & Company's Ship Lighting.—An electric lighting set for ship lighting has just been designed by this firm, whose London address is at 8 Princes street, Westminster, S. W., and who have made the lighting of ships a specialty. The particulars are given as follows: The machinery, which occupies a space of about four and a half feet by three feet, and whose first cost is little over £100, is capable of working eighty 16 candle-power lamps. The engine runs about 200 revolutions per minute and the dynamo at 700, giving great efficiency without any undue wear and tear. A specially designed link-belt couples the dynamo to the engine, and by another pulley arrangement a strong grip is secured on the dynamo pulley, and, though the space is so small, there is no slipping. In addition to efficiency the great necessity in ship electric lighting is the taking up of little space, and this, as well as small cost, would appear to be secured.

Personal.—Mr. Holland Dell, the late secretary of the Electrical Power Storage Company, has been appointed sole representative for the United Kingdom and Colonies of the Paris carbon manufacturers, Messrs. Lacombe & Company, whose London offices are 7 Little Queen street, Westminster.

The Isle of Wight.—Preliminary surveys are being made by a London engineering firm as to the practicability of constructing an electric tramway in such districts of the island as are too rough to allow of an ordinary railway, except with great outlay.

Edinburgh Exhibition.—The executive council of the exhibition have requested Messrs. Galloways to provide the steam required, and five of their boilers, 30 feet by 8 feet, will be supplied for that purpose.

The Cost of Electric Light in Paris.—Our esteemed contemporary, the *Electrical Engineer*, gives some interesting particulars of the cost of production of the electric light at the various installations undertaken by the Paris Municipal Council and which are given in a recent report by M. Paul Brousse, one of the Municipal Counselors.

The Hotel de Ville.—The installation comprises 500 sixteen candle-power lamps and 4,000 ten candle-power lamps, the latter run on fête days. The plant comprises two Edison dynamos, 110 volts and 200 amperes, five Gramme dynamos, 110 volts, three of 250 amperes and two o 500 amperes. The cost of maintenance is 8.4*d.* per 16 candle-power lamp hour. The lighting is only maintained during certain months of the year, and three or four times only with the whole of the lamps.

The Secretary to the late Birmingham Electrical Exhibition has lately informed Messrs. Ruston, Proctor & Company, Limited, of the Sheaf Iron Works, Lincoln, that they have been awarded a special first-class gold medal for the compound medium-stroke fixed engine which was used for driving the counter-shaft in the dynamo room.

At the last Meeting of the electrical trades committee of the London Chamber of Commerce, Mr. R. E. Crompton, who presided, spoke of the trouble taken by the Chamber to make the forthcoming electrical exhibition at Edinburgh as popular as possible, and of how unsuccessful the efforts had been, owing, no doubt, to the fact that people were surfeited with exhibitions. Major Flood-Page, who had been abroad for some weeks, said he had been informed and had read in the papers that the whole of the space at the exhibition had been applied for three times over. He had also heard that the French government had recognized the exhibition and that the exhibition authorities were paying all the expenses of bringing over the French electrical exhibits. In Berlin he was told that a very large German organization was going to exhibit at Edinburgh. Altogether he hoped the exhibition would be a success.

Place du Carrousel.—Since July, 1889, has been lighted with Pieper lamps driven from the Edison station in the Palais Royal. The lamp hour (probably 300 candles) works out at 6.3*d.*

Parc Monceau.—The parc is lighted by 20 Jablochkoff candles, fed by three Gramme alternate current dynamos. The price of the arc hour is 4.8*d.* (About 200 candle-power).

Buttes Chaumont.—Here 46 Brush arc lights, about 400 candle-power, are run in series, and 16 lamps of 16 candle-power are also installed in a restaurant. The cost is 2*d.* per 16 candle-power, or 4*d.* per arc hour.

Station des Halles.—No actual data are yet given, but M. Meyer calculates that the 100 watt hours will cost 5*d.* or 6*d.*, including all cost except rent.

Grands Boulevards.—During the Paris Exhibition the lighting was carried out by the Popp Company, the Edison and the Société Rothschild-Marcel Deprez. The expenses are as follows: Popp Company, 40 arcs, 700 candle-power, of 10 amperes, 10.05*d.* per arc hour; Edison Company, 37 arcs, 700 candle-power, of 40 amperes, 8.2*d.*; Société pour la Transmission de la Force, 27 arcs, 700 candle-power, 10 amperes, 8.2*d.* per arc hour. The total expense incurred for the municipal lighting by electricity in Paris amounts to 782,750 francs, of which 100,000 was appropriated for trials.

Brussels.—The electrical commission have recommended the municipal council to accept the tender for supplying electric light, The tenders, which are based upon the scale of charges drawn up by the commission, are those of the Société International d'Electricité de Liége, working with M. M. Cassel et Cie, of Brussels; Siemens and Halske, and the Allgemeine Gesellschaft, of Berlin, for the center of the town. The concession for the other portion is to be given to M. Van Rysselberghe, comprising the quartier Notre Dame aux Nieges, the quartier Léopold, the avenue Louise, and a portion of the south of the town.

Liege.—In June next a national and international exhibition is to be opened, and it is expected that the electrical exhibits will be strong both in number and in quality.

Holland.—The first electric tramway is to be opened in March next, and will run from the Hague to Scheveningen, a distance of about four miles.

Berlin.—It has been decided to light the Niederschlesisch Märkischen Bahn Station by electricity, and the cost has been estimated at 103,000 marks.

Electric Insurance Risks.—I learn that a company is in course of formation in this country on a similar principle to the Electric Mutual Insurance Company, of Boston, Mass. Up to the present, it has been made a favor by the insurance companies to pass the electric light, and no discount whatever has been allowed. A company which will offer special rates when the lighting is by electricity, is most certainly required, and ought to prove a great success.

CHARLES FFRENCH.

London, Feb. 28, 1890.

Mr. A. B. Chandler on the Question of a Government Telegraph.

The following is the statement made by President Chandler, of the Postal Telegraph Company, to the Congressional committee which is considering the question of a government telegraph:

The plan proposed by the Postmaster-General, briefly stated, I understand to be this:

The Post Office Department is to furnish office room, office furniture and fixtures, the telegraph apparatus within the offices, the blank forms both for messages to be sent and those on which messages are to be received for delivery, the operating service, and such clerical service as may be required within the post offices, the stamps to be employed for the payment of messages, and the carriers who are to make delivery of telegrams in connection with their delivery of letters, etc., for the Post Office Department. All this to be subject to the condition that no liability shall accrue against the Post Office Department or the telegraph companies, in the handling of such business.

The telegraph companies are to make the necessary wire connections between one or more of their offices and the post office at each "letter carrier" city or town, and lease to the Post Office Department of the United States the wires necessary for the transmission of such telegraph business as the Post Office Department may be able to secure; including, of course, the maintenance of such wire connections and wires, and supplying the same with electric current.

There are several important objections to the carrying out of such a plan. It would not, perhaps, be impracticable so far as the handling of business in that way is concerned, but there is no reason to believe that it would create a new class of messages that would prove of any value to the public, except by the use of rates which are impracticable upon any other basis than such as may result in inevitable loss. If it were to be undertaken, instead of proceeding upon the theory that the government shall lease all the wires that may be employed for such a purpose, and undertake the entire operating service involved in it, I think it would be a much better plan to make a proper division of the tolls upon business so handled, employing wires which would be otherwise occupied a part of the time in many cases, instead of setting apart wires exclusively for the Post Office Department, for the reason that, in a large number of cases, particularly between comparatively unimportant points, it would be found that there would not be business enough of this class to fully occupy the wires; and for the additional reason that it would often be indispensable to make repetitions of business between distant points, which could not be done by the employés of the post offices, but would necessarily be provided by the telegraph company at its repeating stations. It should be understood that there is no business, unless it may, perhaps, be that of farming, which is so dependent upon the weather and atmospheric conditions as that of the telegraph. The operation of long circuits, which is entirely practicable under favorable conditions, is frequently impracticable by reason of unfavorable conditions of weather and otherwise, and the repetition of messages at comparatively short intervals of distance is necessary. Such repetitions can only properly be provided for at points where large "main batteries" are maintained, and such a service can be much better supplied, together with all that appertains to it, by the telegraph companies than by the Post Office Department.

I am confident that the government could not lease wires exclusively for such a business, at any price which the telegraph companies could afford to accept, and carry on the business exclusively by its own employés at rates less than those now charged by the telegraph companies, without incurring loss; and the leasing of wires for the handling of such business exclusively by post office employés, at materially reduced rates from those now charged by the telegraph companies, would establish a competition with themselves, over their own properties, which could not fail, in my opinion, to prove a serious injury to the companies. If it should be undertaken in the manner I have suggested, its growth and development could be provided for according to the merits of each case, and the serious questions then to be considered by the telegraph companies would be as to the rates to be charged, the division of tolls as between the Post Office Department and the telegraph companies, and the effect upon what may, perhaps, properly be termed the "commercial" telegraph business, covering all that is now transmitted by telegraph, as distinguished from the new class of business which might be developed through the Post Office Department.

As to the rates: It is not too much to say that nobody can safely predict just how far a reduction from the existing telegraph rates can properly be afforded, under such conditions as are contemplated in the plan of the Postmaster-General. It is absolutely certain, however, in my judgment, and in this opinion, I have no doubt every person connected with the telegraph business of this country who is aware of the facts will concur, that until new methods of transmission and handling of business can be brought into use, such as are now unknown, messages by telegraph, requiring transmission, letter by letter, and character by character, and to be handled many times over, by different persons, from the time of their reception from customers to the time of their delivery as addressed, as is now necessarily done, cannot be received, transmitted and delivered by such skilled labor as is indispensable to an efficient telegraph service, for any distance, for the sum of 10 cents per message. I say this, taking fully into account the fact that the plan under consideration contemplates that the message shall be paid for in stamps, avoiding most of the accounting service now indispensable to telegraph business; and also the fact that the post offices are to be used, which might somewhat reduce the cost of rent as compared with that now paid by the telegraph companies. It will be observed, however, from the accompanying statement, that the entire cost of rent to our company for the year 1889, amounted to only two and one-half cents per message. The Postmaster-General appears to attach great importance to the economy which he thinks the Post Office Department could introduce by making use of the services of its present employés. I am sure this will be found fallacious in post offices of such size and importance as are favored with a free delivery. Telegraph operators having any considerable business to do cannot, at the same time, act as post office clerks; nor can post office clerks at offices of such importance, even if they are telegraph operators, attend to telegraph business with anything like such promptness and efficiency as would make the service in any degree useful or satisfactory.

Until other means of transmission and other methods of handling telegraph business, and of construction and maintenance of telegraph lines, than are now existing, can be devised, I sincerely believe that such a business as the Postmaster-General contemplates cannot be safely undertaken between points within any one State, or within a radius of 300 miles, for a less rate than 20 cents. And it would be much better, in my opinion, to maintain the present 10 word basis of a message, allowing the place from, date, address and signature, to be sent free, as is done by the telegraph companies. The change proposed in the word basis of a message would, I think, so far as the amount of matter transmitted is concerned, be of small consequence either to the customer or to the telegraph companies, and it would be a decided advantage in the handling of business to observe a uniform plan. An important objection to charging for the address, is the temptation thus afforded to insufficiently addressed messages, making delivery difficult or impossible.

I am inclined to think that a 30 cent rate might be applied to such business between points beyond the State, or the 300 mile limit and points not exceeding 1,000 miles; and that a 50 cent rate might be properly applied to business of this character between points not exceeding 2,500 miles.

If such a business should be undertaken, it could hardly be considered other than experimental, and I earnestly hope that in dealing with this question our Congress and officers of government will carefully avoid any plan that is likely to bring disappointment to its promoters, and that the rights of the telegraph companies now existing, whose properties have been constructed and equipped at vast cost, shall not be jeopardized by a threatened competition on the part of the United States Government (which is able, by the great means at its command, to injure or destroy any business with which it may come in competition), upon the theory of conducting business in the interest of the public at large, and without regard to private and corporate rights or to the earning of any profit, or as to whether the system shall be self-sustaining.

Whatever may have been the experience of other telegraph companies in the use of the low rates prevailing previous to November 1st, 1887, the fact in relation to our service is, that we fell short during their use, from $4,000 to $12,000 per month in meeting our operating expenses, which were reduced as low as practicable, as it will be easily understood such extreme need for economy demanded.

In conclusion let me urge that the government should not be led to the undertaking of this business, in whole or in part, upon any mistaken theory as to actual earning power or cost of operation.

TELEGRAPHIC

.... The Western Union Telegraph Company are erecting a telegraph line from Danville, Va., to Portsmouth, and are completing six miles a day. The distance is 220 miles.

.... The Illinois Electric Material Company has been formed at Chicago; to deal in electric goods; capital stock, $25,000; incorporators, A. J. Stone, E. F. Abbott and C. E. Byrne.

.... The electric railway company, of Saratoga, has voted to increase its capital from $50,000 to $150,000, that the road may be extended to Ballston Spa and possibly to Rock City Falls. The consent of nine-tenths of the property owners has been secured for the proposed extension.

.... Experimental work is being carried on by several well-known electrical inventors, with excellent prospects of success, in the matter of signaling through submarine cables. The Wheatstone automatic apparatus, which not many years ago was considered to be rendering excellent service when it attained a speed of 80 to 100 words a minute, has been so far improved that 600 words can now be reached in actual practice, and not simply when the instrument is worked through a plain resistance or through a looped line without an earth connection. A new automatic signaler is said to be doing good work in England over cables of moderate length.

.... The New York Telegraph Club a few days ago held its first annual election since its organization in February, 1889. Since then the club has grown from 14 to 250 members, and of the latter number 141 turned out to vote between the hours of eight A. M. and eight P. M. The voting was done according to the Australian system. The officers elected were: E. E. Brannin, president; R. Kane, first vice-president; W. B. Richardson, second vice-president; Dr. P. J. Byrne, third vice-president; C. J. Powers, recording secretary; R. J. Marrin, financial secretary; John Brant, treasurer; M. C. Sink, librarian, and Paul Sheehan, N. D. Webster and Dr. P. J. Byrne, members of the board of audit.

.... Telegraph operators with a sense of the ludicrous sometimes find their dull, every-day routine enlivened by the amusing messages handed in by their customers. An operator in a small Western town was sitting alone in his office, when an old lady entered who informed him that she wished to send a message to her daughter.

"How much will it cost?" she asked.

"Fifty cents for ten words."

"How much for five words?"

"The same. We do not send any messages for less than fifty cents."

"All I want to say is, 'I will come home to-morrow,' and that will be the same as if it were ten words, eh?"

"Yes, ma'am."

"Well, I may as well have my money's wuth," she said, reflectively. Then, holding up one hand and counting the words off on her fingers, she added, "Johnny—cut—a—tooth—yesterday."

"There," she said, "you send that along, too, to make us even," and with a comfortable sense that she had not been defrauded by the company, she went on her way.

The operator was of too sympathetic a nature to be amused over the distress of a young man who, three minutes after the departure of the last train for the day, rushed up to the window and dashed off the following message to be sent to a town 60 miles away, addressed to a Miss Something-or-other:

"Have just missed train. Must postpone ceremony until to-morrow. Would walk there if I could. Try to be calm."

* * Covington, Ky., is building electric railways.

* * Schenectady, N. Y., is to run its street cars by electricity.

* * Cleveland and Detroit are experimenting with storage battery cars.

* * St. Paulites are well pleased with one of their electric lines, just completed.

* * It is proposed to light the Colorado University, at Boulder, with electricity generated on the premises.

* * Buffalo citizens have been inspecting the overhead system in Cleveland, with a view to its introduction in Buffalo.

* * The Bangor, Me., Electric Railway is to be extended in the spring, when about eight miles of new track will be laid.

* * The Fitchburg, Mass., Street Railroad Company is to extend its tracks to Leominster, and will use electricity instead of horses.

* * The following cities propose to build electric railways during the coming spring: Providence, R. I.; Helena, Mont.; Dubuque and Keokuk, Iowa.

* * Seventeen carloads of rails, for the Waverly-Woodstock Electric Motor Line, arrived in Portland, Ore., last week, and another electric road will soon be running in Portland.

* * The Lebanon, Pa., Electric Street Railway Company, having made an amicable arrangement with the Bucks and Dauphin Turnpike Company, which owns the principal streets through the city, will begin the work of construction at once.

* * The Oldtown Electric Company, Maine, has been formed; purposes, transmission of light, heat and power, by electricity, within the limits of Penobscot County. President, F. A. Wyman; treasurer, Phœbus H. Alexander. Capital stock, $25,000; amount paid in, $10,000; par value of shares, $25.

* * At the annual meeting of the Sprague Electric Railway and Motor Company, held in New York last week, the following named gentlemen were chosen directors for the ensuing year: Henry Villard, in place of Professor Barker; C. H. Coster, in place of Dr. Duncan; J. H. Herrick, A. Marcus, E. H. Sprague, John S. Wise, C. A. Spofford and S. Insull.

* * A large delegation of the city fathers of Buffalo, N. Y., visited Boston recently to inspect the workings of the overhead wire system of the West End Street Railway Company. In the party were William Summers, president, and John T. White, S. Schen, Jr., John Kreitner, T. Williamson, J. J. Kennedy and George Helfrigh, members of the board of aldermen.

* * The North Side Street Railway Company, of Minneapolis, filed articles of incorporation with the Secretary of State recently. The capital stock is $500,000, and the object is to deal in suburban property, construct, maintain and operate, street railway lines. The incorporators are Thomas B. Walker, John M. Moon, George P. Wilson, of Minneapolis, and Daniel M. Robbins and Andrew B. Robbins, of St. Paul.

* * Messrs. Lewis & Fowler, the Brooklyn, N. Y., car manufacturers, are building 24 cars of the same pattern as those lately put on the Fulton street surface line for the Long Island electric branch of the Smith and Jay street surface line. President Jourdan stated that the repairs on the road, changing it from a single track horse motor line to a double track electric motor railway, would be finished by the end of this month. The road will be opened April 1.

* * The Chicago corporation owning the street car lines of Indianapolis, Ind., has won its fight for a long-time charter in the suburb of West Indianapolis, the town authorities having given a charter for 35 years, on no condition except that the company shall connect the suburb with the city. Either animal or electric power may be used. The company will at once put down several miles of track. The franchise is said to be worth $5,000 a year, but Manager Shaffer secured it for nothing.

Big Street Railway Deal.

By long odds, says a Pittsburgh exchange, the most extensive street railway legislation ever enacted in Pittsburgh has just been rushed through city councils. The scheme was sprung without previous general notice, and accomplished inside of two hours, giving over to the corporations interested about all the streets in Pittsburgh of any consequence now unoccupied by street car lines.

The matter came up in the shape of ten ordinances, giving rights of way to as many railway companies over every available street in the city, from Market street, in the heart of Pittsburgh, to Wilkinsburg, about seven miles out.

Electricity and cables will be used. The corporations will begin work as soon as the weather permits, and, at the expenditure of $3,000,000, secure rapid transit from nearly every locality in the great East End section of town to lower Pittsburgh.

The National Fast Telegraphing Tournament—A Suggestion from Mr. Chandler.

The following allotment of prizes for the telegraph tournament, to be given in this city April 10, 1890, is announced by Mr. Fred. Catlin, manager of the contest:

Class A.....	First Prize,	$100;	Second Prize,	$75.
Class B.....	"	85;	"	65.
Ladies' Class..	"	50;	"	40.
Old-Timers....	"	50;	"	40.

A QUESTION OF NERVE.

In sending in his subscription to the prize fund, Mr. A. B. Chandler, president of the Postal Telegraph Cable Company, said he thought it very desirable that the "work" should be strictly accurate and the copy of the receiving operators clean and in right form.

"I have no doubt that this is well recognized by all operators who are sufficiently expert to take part in such a test as is proposed to be made; but for the benefit of the younger operators, and of the telegraph service, I take the liberty of suggesting that in dealing with this subject, its promoters shall make it plain that a firm touch, and absolutely correct work and clear copy, are to be sought for, as well as swift sending.

"I will give a prize of $10 to the operator who in this trial shall be adjudged to be the cleanest and best sender, regardless of speed, and another prize of $10 to the receiving operator who shall make the clearest and best 'pen and ink' copy, including all the 'earmarks' required for the identification and record of messages."

Manager Catlin replied "that it is only in rare cases where an operator on trial, under the critical inspection of hundreds of experts, has sufficient control of his nerves to make a creditable showing. Some of our very best operators, under the severe trial, would fail, while, in a less conspicuous position they could copy these rapid transmissions with ease. It is largely a question of nerve. Arrangements have been made to have the transmissions received by an expert typo-telegrapher, and recorded on the caligraph. However, should any operator desire to compete for this prize, and the honor attached, the opportunity is offered them.

"I also note your offer of a prize to the operator who makes the best transmission, regardless of speed, and will place it before the contestants."

Mr. Chandler further states that he appreciates the "fact that the making of a clear and complete copy by receiving operators at a high rate of speed, especially when under observation and criticism, requires not only good penmanship and careful work, but strong nerves It is true, however, that nearly all our business must, for some time to come, be received by 'pen and ink,' and to excel as a receiver and copyist, in accuracy and legibility, is, in my opinion, more difficult, and requires a higher order of skill and intelligence than to be a fast and true sender. I shall, therefore, feel somewhat disappointed if some of our operator 'artists' do not compete for this prize."

The Electric Lighting of the Progress Club, of New York.

There are few places where the electric light shows to better advantage than in a private residence or club, not only on account of the effective aid which it lends to decorative effects, but also because it does not heat or vitiate the atmosphere and destroy ceilings or decorations. Seldom have we seen a better example of this than that afforded by an inspection of the magnificent building in which the members of the Progress Club have just installed themselves, at the corner of Sixty-third street and Fifth avenue.

The club building itself is a model of luxury and comfort, and well merits a cursory description, indicative of the accommodation which club men of the present day consider themselves entitled to. The building is erected on a lot, or, rather, on four lots, measuring 100x100 feet; eight feet being left on the Sixty-third street side to provide an alleyway for light-shaft and service staircase, the actual measurements of the building are 100x92, the height above the sidewalk being 80 feet. There are three principal stories besides *entre sol* and mezzanine floor, making five stories in all. The basement is occupied by the bowling alley, billiard room and café, and the usual steward's offices, store-rooms, etc. From the main hall, on the first story, which extends right through the building and is 20 feet wide, open the library and drawing rooms, forming a connected suite of apartments. On the other side of the hall are a small dining-room, a committee room, and the offices of the club. On the next story is the grand dining hall, a magnificent room, measuring 90x55 feet and 25 feet in height.

Above this, again, is the ball room, which is probably one of the finest in the country, and is a splendidly proportioned room, the dimensions being 90x65 feet, and 35 feet high. At the west end is a large gallery running the full width of the room, and capable of seating 100 persons. Opening from the ball room are a beautifully decorated ladies' parlor and a spacious foyer. The mezzanine floor and *entre sol* are given up to card and smoking rooms.

These palatial quarters have been equipped with electric light throughout, electric bells and electric gas-lighting apparatus, by the Tucker Electrical Construction Company, of this city. The electric lighting installation is very complete and well merits a detailed description. In the basement are placed two 650-light Mather compound-wound automatic dynamos, each one driven directly by a 75 horse-power Armington and Sims engine. The dynamos are perfectly automatic in their action, and any number of lamps can be turned off or on, the E. M. F. remaining practically constant. The two dynamos are coupled in multiple, the installation being wired on the three-wire system. In the dynamo room is placed a main switchboard mounted on a solid slate base. The mains from each dynamo go to a double-pole switch by means of which either or both dynamos can be entirely cut off from the circuits. All of the circuits are also provided with double-pole switches so that any circuit can be completely isolated from the rest, should such a necessity arise. The switchboard is also provided with two Mather ammeters which are kept constantly in circuit, so that the output of the two dynamos is always in evidence. As the usual current output of each dynamo ranges between 200 and 250 amperes, the scale of the ammeter is so calibrated that the divisions between those two figures are much larger than those above or below, which arrangement renders accurate reading of the indications of the ammeter a matter of great ease. A voltmeter which can be switched on to either machine, and a rheostat used for lowering the E. M. F. of the dynamos when starting up, form the remaining features of the switchboard. The different circuits are controlled by sets of switches placed in accessible situations in the different rooms and halls, so that any number of lamps can be turned on or off with great ease. The electrolier which lights the main staircase on the second story is provided with two switches, so that the lights can be turned on or off either from the same floor or from the main hall where the second switch is placed, a very convenient and novel arrangement. There are, in all, some 1,250 lights distributed throughout the building. The standards, electroliers and fittings, furnished by Snyder & Campbell, of New York, are all of the most artistic design; those in the halls and staircases are of wrought iron in very handsome antique patterns. In the different rooms are metal brackets, fixtures and electroliers, designed to harmonize with the different styles of decoration in which the rooms are treated. The fittings of the grand dining hall are all of silvered metal, the standards being ornamented with slabs of onyx and malachite, having a very beautiful effect.

To the lighting of the ball room special attention has been paid, and resulting in the production of a very noteworthy feature of the installation. A special circuit runs from the switchboard in the dynamo room to another switchboard in the ball room itself. The switches here are mounted on a marble base, enclosed by an ornamental cupboard, which, when closed, forms part of the decoration of the room. On this marble base are 21 switches, which control the entire lighting of the ball room in sections. The distribution of 580 lamps, which are installed in this regal apartment, is very effectively carried out. The arches of the ceiling are dotted here and there with lamps half concealed in the *papier-maché* designs and figures, which constitute the decoration of the arches. The ceiling proper is divided into a number of panels, from the center of each of which hangs a cluster of lamps, suspended from long graceful stems, the lamps being so arranged as to present the appearance of a skyrocket in the act of bursting. Round the sides of the room are placed statues of onyx and ormolu supporting torches formed of clusters of electric lights. The whole effect is particularly pleasing and tasteful, and it has seldom been our good fortune to see a ball room so beautifully lighted. With any other illuminant than electricity it would be impossible to produce such an effect. The ball room and grand dining hall are provided with auxiliary gas fixtures, in case the electric light should at any time fail—an event which is not likely to ever take place. The gas in both these rooms can be lighted by electricity by means of static generators and switches placed on the marble switchboard in the ball room. The east end of the ball room can be converted into a temporary stage for dramatic performances or concerts, and the switchboard is so arranged that circuits can be run out for footlights and border lights, while directly beneath it are placed a number of rheostats to be used for raising or lowering the lights as may be required.

The whole of the wiring of the building has been done with Grimshaw white core, about 50,000 feet of this having been used. Taking it as a whole, the installation is one of the most complete and well thought out that we have had the opportunity of inspecting, and reflects great credit on the contractors, the Tucker Electrical Construction Company, and on their electrician, Mr. H. A. Sinclair, under whose personal supervision the whole of the work has been carried out. Such installations form standing examples of what electricity can do in proper hands, to surround man with those environments of health, luxury, comfort and beauty, which do so much towards making life worth living—in a club.

We augur a prosperous existence for the Progress Club. Already more than 400 members are enrolled, the limit being 500. The president is Mr. Simon Goldenberg; the vice-president, Mr. J. H. Lowenstine, and prominent among the directors is Mr. W. H. Stiner, a well-known ex-journalist, who served for many years on the staff of the *Herald*.

Exposing Telegraph Schools.

Labor Commissioner Merriweather, of St. Louis, finds time to take a peep at the telegraph schools of that city. Some of them are legitimate but some are palpable frauds. The frauds are going to be exposed.

The investigation began at the commissioner's office, 108 North Fourth, last week, many disappointed scholars appearing. It will continue until the milk in the telegraph cocoanut is exhausted.

* * The four unique features of the Pennsylvania Limited, entirely original with this train, are the financial reports, ladies' maids, stenographers and typewriters, and the observation car. No other train in the world affords like convenience. The limited leaves New York, stations foot of Cortlandt and Desbrosses streets, every day at 10 A. M., for Cincinnati and Chicago.

The Rights of Electric Street Railways.

POLES FOR SUPPORT OF OVERHEAD TROLLEY WIRE DO NOT ENCUMBER THE STREETS —INJUNCTION REFUSED.

The following is the text of the decision by the Supreme Court in the case of Philip S. Taggart *et al. vs.* the Newport Street Railway Company, given by Chief Justice Durfee in Providence, on Saturday, January 25, 1890:

This bill is brought by the complainants as abutters on certain streets in the city of Newport, along and over which the tracks or rails of the defendant company's street railway have been laid. The object is to have the company enjoined from erecting or maintaining certain poles and wire in the streets in front of their estates. Said poles were erected to support said wire over said tracks for the conduction of electricity, which is used as a motor for the passenger cars traversing said tracks. The poles are placed along the margins of the sidewalks of said streets about 120 feet apart, and were placed so by permission of the City Council of the city of Newport given by ordinance. The case was submitted on bill and answer, no replication having been filed. * * * *

The distinction is often stated as a distinction between steam and horse railroads; but the distinction properly rests, not on any difference in motive power, but on the different effect produced by them respectively on the highways or streets which they occupy. A steam railroad is held to impose a new servitude, not because it is operated by steam, but because it is so operated as to be incompatible with the use of the street in the other usual modes, or in other words, so as practically to exclude the usual modes of use.

The only considerable privilege which the horse car has over other vehicles is that, being confined to its tracks, it cannot be turned aside for other vehicles, while they are forced to turn aside for it; but this is an incidental matter, insufficient to make the horse railroad a new servitude.

The street railway here complained of is operated neither by steam nor horse power, but by electricity. It does not appear, however, that it occupies the streets or highways any more exclusively than if it were operated by horse power.

The answer avers that "electricity, besides being as safe and as easily managed as horse power for the propulsion of street cars, is more quiet, more cleanly, and more convenient than horses, both for residents on the streets used by said cars and for the public generally, and also causes much less wear and injury to the streets and highways than is occasioned by street cars, of which horses are the motive power." These averments, the case being heard on bill and answer, must be taken as true. We see no reason to doubt their truth. It is urged that electricity is a very dangerous force, and that the court will take judicial notice of its dangerousness. The court will take judicial notice that electricity, developed to some high degree of intensity, is exceedingly dangerous, and even fatally so, to men or animals when it is brought in contact with them; but the court has no judicial knowledge that, as used by the defendant company, it is dangerous. The answer denies that it is dangerous to either life or property. It is also urged that the cars, moving apparently without the application of external force, alarm and frighten horses. This, so far as it is alleged in the bill, is denied in the answer. We see no reason to suppose that this form of danger is so great that, on account of it, the railway should be regarded as an additional servitude. The answer alleges that a great many street railways, operated by electricity in the same manner as the railway of the defendant is operated, are in use in various towns and cities in different states, and that many others are in process of construction.

Reference has been made to cases which hold that telegraph or telephone poles and wires erected on streets or highways constitute an additional servitude, entitling the owners of the fee to additional compensation; and from these cases, it is argued that the railway here complained of is an additional servitude, by reason of the poles and wires which communicate its motive power. There are cases which hold as stated, and there are cases which hold otherwise. But, assuming that telegraph and telephone poles and wires do create a new servitude, we do not think it follows that the poles and wires erected and used for the service of said street railway likewise create a new servitude. Telegraph and telephone poles and wires are not used to facilitate the use of the streets where they are erected for travel and transportation, or, if so, very indirectly so; whereas the poles and wires here in question are directly ancillary to the uses of the streets as such, in that they communicate the power by which the street cars are propelled. It has been held, for reasons which we consider irrefragable, that a telegraph erected by a railroad company within its location for the purposes of its railroad, to increase the safety and efficiency thereof, does not constitute an additional servitude, but is only a legitimate development of the easement originally acquired.

Our conclusion is that the complainants are not entitled to the relief prayed for on the grounds alleged, and that the bill be dismissed with costs.

Electric Lighting Appliances.

A few of the detailed appliances of incandescent lighting are shown on this page. The ceiling cut-out is made with porcelain base and cover, and makes an artistic addition to the ceiling, instead of spoiling the appearance of the part to which it is fastened. Porcelain has proven its efficiency and desirability for such work, and is being very largely used of late by the Sawyer-Man Electric Company, the manufacturers of this cut-out. In Figs. 2 and 3 is shown the new expanding wire lamp guard, for which a patent has been applied, and which is made specially to fit the Sawyer-Man lamp. No holders are required for this guard, as the slides, which, it will be seen, are down near the middle of the guard in Fig. 2, have been pushed to the lamp socket in Fig. 3, tightly clamping it. This is a very convenient lamp protection.

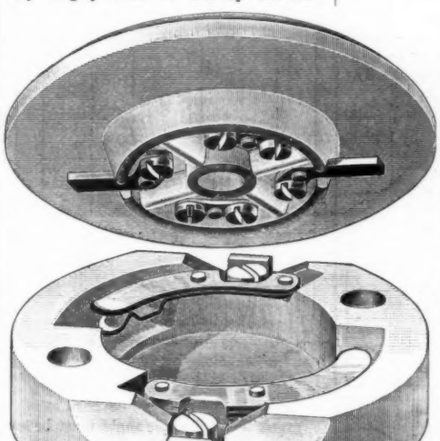


FIG. 1.—NEW CEILING CUT-OUT OF THE SAWYER-MAN ELECTRIC COMPANY.

FIGS. 2 AND 3.—EXPANDING-WIRE LAMP GUARD.

Earnings and Expenses of the Westinghouse Electric Company (and Leased Companies) for the Year 1889.

The following statement of the business of the Westinghouse Electric Company for the past year shows the great strides made in this field by this progressive company. The sales for the second half of the year are nearly twice as great as for the first half, and this is said to be largely due to the fact that the leased companies were practically not in full operation until the first of July, 1889. The statement, as sent out by Secretary A. T. Rowand, is as follows:

Total sales for the year	$4,362,115.22
Cost of manufacture, including material, labor, manufacturing supplies, and all royalties paid	2,942,138.30
Manufacturing profit	$2,119,976.92
General expenses (including repairs to factory, machinery and tools)	767,087.56
Gross profit	$1,362,889.35
Lease and rentals (paid to leased companies)	215,555.94
	$1,137,333.31
Extraordinary expenses, patent and legal, experimental, interest and discount	407,525.54
Net profits for the year	$729,807.87

NOTE.—The repairs to factory, machinery and tools, amounting to $96,135.58, also the experimental expenses, amounting to $62,146.07, have been charged out to the current year's business.

Sales for six months ending June 30, 1889	$1,492,406.15
Sales for six months ending Dec. 31, 1889	2,896,709.07
Total sales for year	$4,362,115.22

New Lighting Scheme.

Says the New York *Press*: "Paris has just taken a step which is a hint to New Yorkers who are agitated over the deadly electric light wires. There are companies in Paris which deal in compressed air for motive power, just as the big steam company and the gas companies deal in steam and gas in New York. One of these companies has just been awarded a contract for street lighting on a novel plan. The company distributes power through its condensed air system to a vast number of small dynamos, each of which furnishes the electric light for a small number of lamps. The electricity generated in this small way is not at all dangerous. The lighting is perfect. The cheapness is said to have been the determinate feature in the letting of the contract. Now, isn't that something for New York to ponder over?"

ELECTRIC LIGHT NEWS

—— The Board of City Trustees, of Napa, Cal., granted the Thomson-Houston Company a franchise to erect and maintain in that town for 25 years, an electric light plant.

—— A long and tedious argument is in progress before Judge Andrews, in New York City, regarding the respective rights of the city and the Standard Subway Construction Company.

—— The Blue Hill Electric Company, Canton, Mass., have purchased of the Revere Copper Company a piece of land near the stone viaduct, for the site of the electric light station. The building will be of brick, and work will be commenced just as soon as the contract is awarded.

—— The Mount Morris Electric Light and Power Company, of New York City, is about to increase the capacity of its central station plant in Harlem. The company ordered a few days ago Westinghouse alternating current apparatus of 1,500 lights capacity. With this addition, the total capacity of the plant will be 11,500 lights.

—— At a meeting of the directors of the Westinghouse Electric Company, held March 5th, at Pittsburgh, Pa., P. F. Kobbe was elected treasurer, and W. L. McCullagh, assistant treasurer, to fill the vacancies caused by the resignations of John Caldwell and A. T. Rowand. No more faithful and experienced men could have been found for these important positions.

—— The Beaver Valley Electric Company, of Rochester, Pa., is about to begin the furnishing of electric light. The organization was chartered a short time ago, and a few days since a contract was made with the Westinghouse Electric Company, of Pittsburgh, for alternating current apparatus. The company will start out with a capacity of 1,000 lights, and increase as occasion demands.

—— The new storage battery for the lighting of cars by electricity, recently tested on the Chicago and Northwestern, has a capacity that will supply 10 lamps with light for 30 consecutive hours. This has been accomplished by other systems, but the point of greatest interest to railroad corporations is that this apparatus weighs but 1,280 pounds, or about one-half the weight of storage batteries hitherto in use. This reduction in weight means a reduction in cost.

—— Slater, Mo.—The city authorities notified the electric light company which lighted the city, that after Feb. 15th they would not pay for any more lights; the lighting being very unsatisfactory. The plant has closed down, and will, in all probability be bought by a local syndicate. The plant is owned by New York parties. The company had a ten-year contract, and was paid $2,250 a year for its lighting. It has only been in operation two years.

—— The Galena Electric Power and Mining Co., Galena, Kas., has been formed; directors, William B. Stone, of Galena; A. W. Walburn, of Fort Scott; Charles E. Hart, of Baxter Springs; Arthur E. Stilwell, Delbert J. Haff, Ira C. Hubbell and Charles S. Rusling, of Kansas City. The capital stock is fixed at $200,000, and all is paid in. The company proposes to locate a motor in front of each mine and operate its machinery by electric power. They will also establish an arc light system in Galena. The Thomson Houston system will be used. Galena is an enterprising, wide-awake coal mining town of 2,000 or 3,000 inhabitants, in the southern part of Kansas. W. B. Stone, one of the directors of the new company, is a wealthy mine owner, and it is for his mines more than any others, that the company was formed.

—— Articles have been filed in the Camden N. J., county clerk's office by the McLaughlin Electric Company increasing the capital. Incorporators Louis E. Pfeiffer, John J. McFarlane, Geo. F. Work, J. F. McLaughlin, Wilson R. Kerr, John J. Sweeney, all of Philadelphia, and William J. Coite, of Haddonfield, N. J.

—— A special meeting of the stockholders of the Kingston, N. Y., Electric Light, Heat and Power Company will be held at the office of the company, in the station of the company in that city, to determine whether the capital stock of the company shall be increased to the amount of $100,000, to consist of 1,000 shares of the par value of $100 per share.

The Theory of Armature Reactions in Dynamos and Motors.

Under this title, Mr. James Swinburne read a paper before the Institution of Electrical Engineers, London, at its meeting held February 13th. The paper is very lengthy, and we herewith present an abstract.

After a few prefatory remarks, the lecturer stated that as C. G. S. units were now used by electrical engineers generally, he would refer to them in his paper:

It seems to be generally supposed that electrical engineers are in full possession of means for designing a dynamo or motor. This is no doubt the case as regards very small machines, and when considered with reference to no load. As not only the excitation necessary at full load, but also the best dimensions of the magnets and the proper shape of the pole-pieces, depend on the armature reactions, and as the armature reactions are of immense importance in large machines, such machines cannot be designed with accuracy unless the armature reactions and position of the brushes at full load can be foretold. The magnetic potential will be denoted by the symbol Ω; and for want of a unit of its own, it may be measured in ergs. An ampere-turn thus gives a magnetic potential of $4\pi/10$ ergs, or 1.26 ergs.

As single-magnet machines are very largely used now, and a type can be taken which is approximately that used by most of the large representative makers, such a machine may be taken as an example. A formula which gives the size of iron, and the excitation needed, will then be worked out.

The vertical line through the center is taken as at zero magnetic potential at no load. Assuming the length of the core to be the same as that of the pole-pieces, and calling the external radius of the core r, and the radial depth of the discs b, and the length of core a and the armature induction B_a, the surface integral of the induction, or what may be for shortness called the total armature induction, is $2\,a\,b\,B_a$. The desired armature induction is here assumed. The distance, l_a, which represents the length of iron that has to be magnetized to the induction B_a, depends on the arc of embrace of the pole-pieces; but a large error in the estimate of this length causes a very small error in the design of the machine, as very little of the excitation is spent on this part of the magnetic circuit. The fall of magnetic potential over $\frac{1}{2}\,l_a\,\frac{1}{2}\,l_a\,B_a/\mu$, and may be written $\frac{1}{2}\,\Omega_a$. The induction in the air gap depends on the armature induction, the radial depth of the discs, and the pole-face angle. It will be written B_g. The line integral of the induction across the gap is $\frac{1}{2}g\,B_g$, where g is the distance across the gaps. $\frac{1}{2}g\,B_g$ may be written $\frac{1}{2}\,\Omega_g$. The fall of potential from the middle of the yoke to the pole-piece depends on the length of the circuit and the induction. It may be written $\frac{1}{2}\,l_m\,B_m/\mu$, or $\frac{1}{2}\,\Omega_m$. As the other half of the magnetic circuit is similar at no load, the line integral of the magnetic force needed in the shunt is $\Omega_s = \Omega_m + \Omega_g + \Omega_m$. As to the length of the field magnets, it depends on the total excitation needed.

At full load the armature induction has to be increased to allow for the resistance of the armature and series coils, and sometimes for the leads also. A higher value is therefore taken for B_a, and therefore for Ω_a. The effect of the armature current itself may be divided into two components; and in the case of a drum armature, which may be taken for the sake of simplicity, the electrical effect is the same as if the external conductors were connected across the ends, as shown in Fig. 1. There is thus a belt of current-turns opposing the field excitation, and another belt acting at right angles to it. These may be called the back and the cross ampere-turns, and the induction produced by them, the back and the cross induction, respectively. The breadth of these belts, or the number of turns in each, depends on the lead of the brushes. For the present the lead of the brushes may be assumed. The extra difference of magnetic potential between the pole-pieces due to the back current-turns is $\pi C n_b/10$, where C is the armature current in amperes, and n_b the number of external armature conductors in the belt of back turns, n_a being the number of external armature conductors. This may be written,

$$\Omega_b = \pi\, C n_b/10 \ldots\ldots\ldots\ldots (1)$$

The difference of potential of the pole-pieces at full load is this: $\Omega_a + \Omega_b + \Omega_g$; and Ω_a and Ω_g are greater than at no load, because the armature and gap induction are higher. The difference of potential between the pole-pieces may be shortly written, Ω_b. In a given type of dynamo the percentage of waste field varies directly as the difference of potential of the pole-pieces, provided the field magnets are not strongly magnetized, and is independent of the linear dimensions. The actual waste field, however, varies directly as the difference of magnetic potential between the pole-pieces, and directly as the linear dimensions, or as the diameter of the armature. If the armature cross-sectional area is $2\,a\,b$, and the armature induction is B_a, and if the field induction desired is B_m, the cross section of the field magnets must be

$$A_m = 2\,a\,b\,B_a/B_m + r\,\Omega_p/M\,B_m \ldots (2)$$

where M is a coefficient depending on the type of the machine. This coefficient can be readily determined from another machine of the same type but of different size, and an error in its estimation makes comparatively little difference in the dynamo.

In ordinary signal-magnet machines M is generally above .08 to .085; in double-magnet machines it is less. Of course a great deal depends on the mounting of the dynamo. A machine let into a bed plate, as is often necessary in the case of direct coupled engines, has more leakage.

An equation for the shunt and series excitation is now to be found. From (1) the field induction is found:

$$B_m = 2ab\,B_a/A_m + r\Omega_p/MA_m \ldots\ldots\ldots (3)$$

Giving the value of B_a and Ω_p at no load, the value of B_m at no load is obtained. The shunt excitation is thus:

$$\Omega_s = l_a\,B_a/\mu_a + g\,B_g + l_m\,B_m/\mu_m \ldots (4)$$

in ergs, or this number divided by 1.26 in

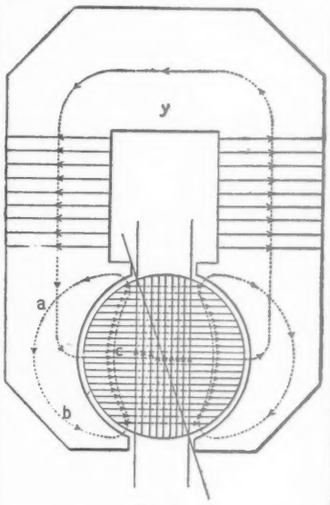


Fig. 1.

ampere turns. By giving the full load values of B_a and Ω_p the total excitation,

$$\Omega_{s+m} = l_a\,B_a/\mu_a + \pi\,C\,n_b/10 + g\,B_g + l_m\,B_m/\mu \ldots (5)$$

is obtained, and, of course, the difference gives the series excitation. Of course the full load field induction has already been assumed in finding the size of the magnets.

It must not be forgotten that all this time it has been assumed that the load of the brushes, and, therefore, Ω_b is known.

Returning to Fig. 1, a closed line, $a\,b\,c$, may be drawn, which is interlinked with all the armature conductors under the pole-piece. The magnetic potential round this circuit is

$$\Omega_c = \theta\,n\,C/10 \ldots\ldots\ldots\ldots (6)$$

where n is the number of armature conductors, and C is the armature current as before, and θ is the angle of embrace of the pole-piece. As the permeability of the iron, both in the part of the armature and of the pole-piece through which this line passes, is great, the whole difference of potential may be taken as being between the core and pole piece. The induction under the leading corner, due to cross current-turns only, is then $-\,n\,C\theta/2g \times 10$, and under the trailing corner it is $+\,nC\theta/(2g \times 10)$. The field is thus weakened under one corner, and, provided the permeability of the iron is practically infinite, equally strengthened under the other, being at its normal value half-way down. The cross induction has in this case no direct effect in increasing or lessening the E.M.F. of the machine. If a dynamo were enlarged to scale, the field excitation would increase as the linear dimensions, but the armature current-turns, assuming the same current-density, would increase as the square of the linear dimensions. Machines with single magnets, and fairly large outputs for the size of their armatures, become difficult to design when they have armatures above 35 to 40 cm. diameter. If the pole-pieces are made small, so as to carry the induction due to the field coils without saturation, one side will be to some extent saturated by the additional induction due to the cross current-turns. If the armature is Gramme-wound, the lower brush will then need more lead than the upper, and sparking at the lower brush in single-magnet Gramme machines thus frequently arises. This effect is sometimes very marked in machines with cast iron pole-pieces.

A double-magnet two-pole machine can be made up to a larger size than a single by shaping the pole-pieces so as to throttle the cross induction. A common type of machine is shown in Fig. 2, with the pole-pieces so cut. If it be assumed for the moment that the armature section current can be reversed with no appreciable field, the largest pole angle that can be used is when the gap induction due to the field excitation is equal and opposite to the cross induction under the leading corner; that is, when

$$\theta = 2\,\sqrt{[(b\,g\,B_a \times 10)/n\,C\,(r \times \tfrac{1}{4}\,g)]} \ldots\ldots (7)$$

As the armature sections need a sensible field

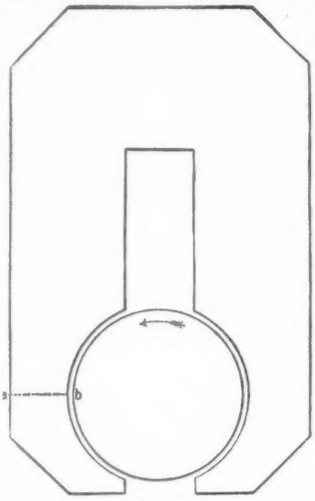


Fig. 2.

to reverse them, the pole angle must be less than this.

As a convolution passes under a brush its current falls from the normal to zero, and then rises to the normal in the other direction, and the brush leaves the commutator strip just at that instant, else there would be sparking. To find what field the convolution must be passing through to produce this result, the variation of the number of lines of induction through the convolution must be found, and the time of short-circuiting known. Any lines of induction through the convolution must pass, 1st, round by the field magnets, thus taking the same course as the field-magnet induction; 2d, through the armature and air gap in the same way as the field induction, and then from pole to pole across the external air like the field leakage; 3d, through the iron of the armature in the immediate vicinity of the conductor, and round the conductor by the air. Fig. 5. In a Gramme armature there are two more paths—4, like 3, only inside the armature ring, and 5, round the ring. The last is neutralized by the reversal of the opposite section, and if an uneven number of sections were used the closed armature circuit would damp it. As to the first, any variation of the induction of the field magnets would be damped by the closed copper field magnet coils, not to speak of the closed armature coils forming the belt of back ampere-turns. In addition to this, if the current died away, and increased up to its normal in the opposite direction uniformly, the current-turns linked with the circuits 1 and 2 would remain constant, for on one side there is a constant increase of back current-turns, and on the other the reversed or forward turns are again crossing the lines 1 and 2. There could thus only be variation of induction round circuits

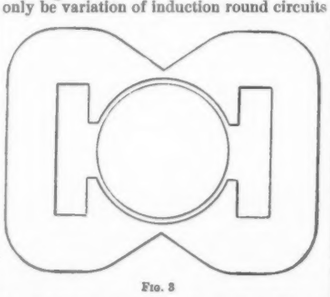


Fig. 3

1 and 2 if the current in the section did not change uniformly. Any change in the induction round such a circuit as 2 would be damped by the Foucault currents produced in the pole-pieces, as the current is small and the frequency enormous.

The third course—3—may be treated as if the convolution were stretched out straight in air. The self-induction could then be calculated. As half the circuit round the wire is through iron, the self-induction may be doubled. The conductor may be taken as a linear conductor, and the self-induction of the active part taken within reasonable limits. To give some idea of the magnitudes dealt with, we may take, as an example, a drum armature of 15 cm. radius and 38 cm. length, with 120 external conductors, giving 100 volts and 400 amperes at 800 revolutions per minute. Working out the self-induction and resistance of a convolution roughly at $1{,}236 \times 10^{-9}$ and .000456 ohm, the electromotive force necessary to bring the current to 200 amperes comes out .274 volt, and the field needed to reverse is $B_g = 685$.

The field necessary for the reversal of the current in a section being known, the position of the brushes can be determined.

If the armature had no current the field would fall off very quickly round the armature after emerging from under the pole-pieces. At no load, for instance, the disposition of the lines of induction is, roughly, as shown in Fig. 4. In this case the lines that enter the uncovered part of the armature are all cramped together at the pole corners. The lines leaving the shanks of the magnets pass right across and do not enter the armature at all.

If the cross current-turns are alone considered, a disposition, roughly, as shown in Fig. 5, is obtained. There are no lines across, so the lines are cramped together where they leave the armature only. If Figs. 4 and 5 were superposed, the opposite inductions would be equal quite close to the leading pole corners. The exact position would be difficult to determine, but by such a rough method as that just described the position can be found so as to make no sensible error in the calculations. It is clear, then, that except in the case of very small machines, or machines with very light loads, the position of non-sparking of the brushes is close under the leading pole corners.

A glance at actual machines shows that the conclusion here arrived at theoretically—that the brushes are almost under the leading pole-corners—is correct. The angle of lead of brushes at full load thus depends on the pole angle, and the back potential, Ω_b, can now be given in the form $(\pi - \theta)\,nC/10$.

Equation (5), for the full-load excitation, can therefore be written,

$$\Omega_{s+m} = l_a\,B_a/\mu_a + (\pi - \theta)\,n\;C/10 + g\,B_g + l_m\,B_m/\mu_m \ldots (8)$$

Equation (2), for the cross-sectional area of the field magnets, also becomes, in full,

$$A_m = 2ab\;B_a/B_m + r\,[l\,B_a/\mu_a + g\,B_g + (\pi - \theta)\,n\;C/10]\;/M\,B_m \ldots (9)$$

Probably the greatest problem that still remains for dynamo makers to grapple with is that of lessening or avoiding sparking at the brushes. At present it is necessary to move them whenever the load of the machine is altered. An attendant is therefore necessary if the brushes are to be kept in good order.

As a very weak field is enough to reverse the current in a section, a small pole-piece might be so applied to the armature as to reverse the sections at any convenient place. If the reversal could take place in such a

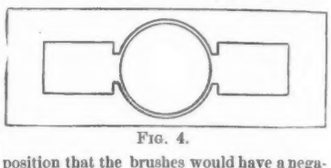


Fig. 4.

position that the brushes would have a negative lead, the back current-turns would be converted into forward current-turns, and a machine could be designed to give constant electro-motive force, or even a higher electro motive force at full load, without any series winding on the magnets at all. Reversing pole-pieces, as they are called, were brought out some two years ago. Fig. 6 shows a simple case. Two reversing pole-pieces are shown. In order that there may be some induction in the same direction as that in the left limb of the magnet, it is clear that the line integral of the magnetic force from A to B must be positive. If the brushes are under these reversing pole-pieces, the line A B passes through the neutral points, and the cross potential in $\pi\,n\,C/10$. Each reversing magnet must therefore have $\frac{1}{4}\,n\,C$ ampere-turns on it to counteract the cross current-turns, and a few more to cause the reversal. In large machines these pole-pieces are thus difficult to work in.

If the reversing pole-piece A is made larger, and attached to the yoke, the same number of magnet turns is necessary, as the yoke is at the same magnetic potential as the center of the armature, if the magnet limbs have equal coils, and the left pole-piece is not highly magnetized.

It is probable that some form of reversing pole-piece will come into general use.

The advantages to be gained by such an arrangement are very great. The brushes do not need to be shifted as the load varies, which saves attendance and wear. Back current-turns are avoided, and this reduces the expense in the series field windings, and saves power now wasted in them. The field magnets can be made smaller, and the induction in them will be the same at full load as at no load, so that the electro-motive force will not be unstable at light loads—a state

of things which is not always avoidable at present.

Having discussed the theory of dynamos, its application to motors is, of course, exceedingly simple. A motor is nothing but a dynamo running the other way, as a dynamo is a practically reversible machine.

Fig. 7 shows a dynamo armature with the position of the brushes and the back and cross armature windings. For simplicity the brushes are shown as touching the outside of the armature instead of the commutator.

Suppose the direction of the currents in the field and armature to remain the same, but the direction of rotation of the armature to reverse, the dynamo then becomes a motor. The brushes must be inclined the other way, as shown dotted, otherwise the ends would catch in the commutator. The cross and back turns remain as before, so that the armature current opposes the field excitation. It has sometimes been said that the armature current assists the field in a motor, but this can only take place if the brushes are given a negative lead. The same result is obtained in a dynamo by putting the brushes back; but in both cases, of course, this leads to excessive sparking. It is sometimes imagined that some effect of the convolutions being commuted acts differently in a motor, but a glance at the diagram shows that the action is completely reversed. The section being commutated in a dynamo, opposes the movement of the armature; in a motor it assists the armature. No appreciable Foucault currents can be caused by the reversal of the section. If any were, they would assist the dynamo and oppose the motor, so that they would also be reversible.

There is no point in which the dynamo is not perfectly reversible, and there is no foundation for the idea that a motor should have a large armature and a weak field. In so far as any motor departs from the design of a good dynamo, it is bad.

Of course the winding of the field magnets in a motor is different.

The winding and design of magnets of motors has received but little attention. Suppose a motor is to run at constant speed on a constant-potential circuit. The shunt excitation is

$$\mathfrak{U}_s = l_a B_{ao}/\mu_o + g B_{go} + \zeta_m B_{mo}/\mu.$$

At full load the armature induction must be reduced so that the full-load current

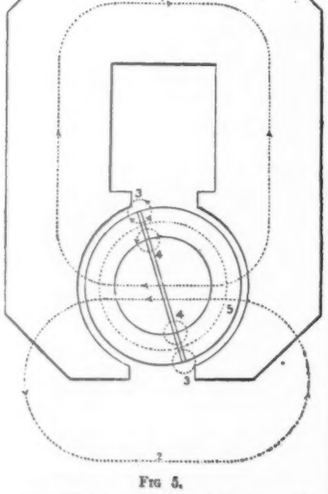


Fig 5.

passes. If E is the terminal electro-motive force and R the armature resistance, the armature induction at full load $B_{af} = B_{ao}(E - C R)/E$, and the gap induction is also reduced in the same proportion. The full-load magnetic potential of the field coil is

$$\mathfrak{U}_{sfm} = l_a B_{af}/\mu_a + (\pi - \theta) n C/10 + g B_g + l_m B_m/\mu_m \ldots (8)$$

The alteration of the first and last terms makes so little difference to the value of $\mathfrak{U}_{mfs}$ or $\mathfrak{U}_s$ that it may be disregarded. The full load excitation is thus increased by $(\pi - \theta) n C/10$, and decreased by the difference between $2 g B_{go}$ and $2 g B_{gf}$. That is to say, extra field excitation is needed to counteract the back current-turns on the armature, and less excitation is needed to produce the reduced air gap induction. If these are equal, the machine will keep constant speed when shunt-wound. In a small or slow machine the armature loss is large; in a large one the back induction is great. A small machine, therefore, needs backward-wound series coils, and a large one forward-wound. If $(\pi - \theta) n C/10 = 2 g B_{go} - 2 g B_{gf}$, the shunt ampere-turns needed at no load and full load differ only by the difference of excitation needed to magnetize the iron of the field magnets and armature.

As the field induction in a motor is highest at no load, the area of cross section is

$$A = 2 a b B_a/B_m + r\Omega_p/MB_m \ldots\ldots (2)$$

it is thus somewhat smaller than in the case of the corresponding compound-wound dynamo.

As a shunt machine is simpler to make than a compound, and as a differentially wound motor may start backwards, shunt winding is preferable. Within wide limits

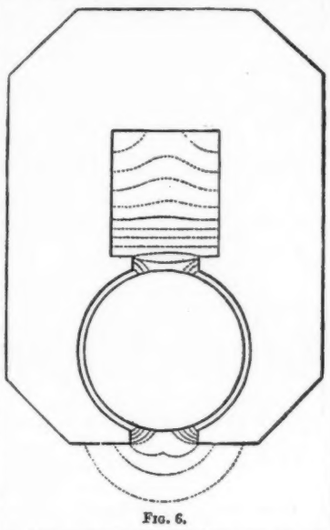


Fig. 6.

of size constant-speed motors can be designed with simple shunt winding. All that is needed is to make $\mathfrak{U}_b$ equal to $2 g B_{go} - 2 g B_{gf}$. $\mathfrak{U}_b = (\pi - \theta) n C/10$, and $B_g = 2 a b B_a \pi l (a + d)(r + \frac{1}{2} g)\theta$, where d is an allowance for fringe, and θ is also made a little large to allow for fringe. This gives

$$\pi\theta - \theta^2 = 20 a b B_a \pi l (a + d)(r + \tfrac{1}{2} g) / n C \ldots (10)$$

This appears to be complicated, but when the symbols are replaced by numbers for an actual machine, of course it is quite simple.

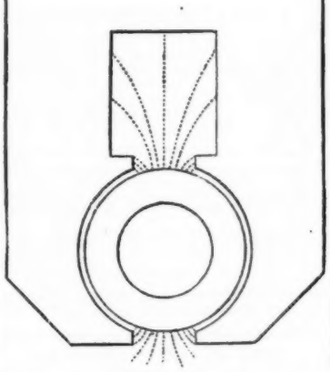


Fig. 7.

It will be found that in very small motors this makes the pole angle too small, while in large machines the pole-pieces would embrace the armature so much as to cause excessive magnetic leakage and reversed induction under the trailing corner, unless the pole-pieces are designed to obviate this.

Demurrer Sustained.

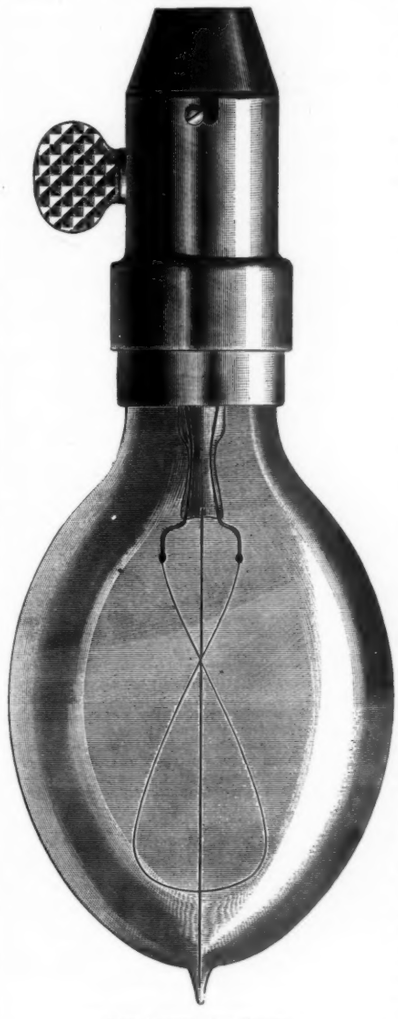
Judge Field, of the Supreme Court, Boston, has sustained the defendant's demurrer in the case of the Suburban Electric Light and Power Company *vs.* the Board of Aldermen, of Boston. The judge says:

"I think that the subject matter of the petition is within the judicial discretion of the board of aldermen, and that this discretion cannot be controlled by this court."

The proceeding was a petition for a writ of mandamus to compel the board of aldermen to grant the petitioner location in the streets of the city for its posts. The petitioner contended that it had a valid contract with the city, made with Superintendent of Lamps Allen, for lighting certain districts of the city, and that under Chap. 109 of the public statutes, the board of aldermen was obliged to grant the location for posts. The statute in question provides, in Section 3, that "the mayor and aldermen of a place through which the lines of a company are to pass shall give the company a writing specifying where the posts may be located." The petitioner will probably take the case to the full court.

A New Incandescent Lamp.

A new incandescent lamp is being introduced after careful experiments and tests, by the Seely & Taylor Manufacturing Company, of this city. It is known as the Backstrom incandescent lamp, a view of which we give in this issue. The lamp is made to fit all sockets, and as the large lamp factories are overcrowded with orders, this new lamp will no doubt meet with a demand at once. The carbon filaments are made from raw silk thread, put through a careful process of manufacture, having a high resistance, and its temperature can be raised without danger of breakage due to sudden shocks by quick switching.



The Backstrom Lamp.

The manufacturers state that the filament does not discolor the globe, as the supporting needle attracts all disintegrated particles of carbon, thus preventing the disintegrated particles from being deposited on the globe, which becomes gradually blackened, thereby impairing the light.

The carbon having the advantage of being supported at both ends, preventing vibrations and drooping, the life of the new lamp is guaranteed, and the claim is made for it that it will last longer than any at present on the market.

The Herkimer Electric Company has been incorporated with the Secretary of State, at Albany, N. Y.; to manufacture and operate machinery and power necessary for producing light, heat and power by electricity, and electric lighting, and to manufacture and use electricity for producing light, heat and power, in the villages of Herkimer, Ilion and Frankfort. The capital stock is $50,000, divided into 500 shares; and the incorporators are Palmer M. Wood, Charles W. Palmer, Cornelius R. Snell, Frank L. Preshaw and Charles Brown.

The Electric Light Situation in Troy, N. Y.

The Troy *Standard* takes this view of the matter: "The giving of the contract to light this city by electricity to the Troy Gas Light Company by the contracting board, is an outrage. That company has no plant, and we believe it does not intend to start a new one. The directors will try to freeze the electric light company out and force it to sell. Then the gas company will scoop it in, and when the next bids are called for, it will charge as much as it pleases for lighting the city, and will get it, too. The rule of Murphy is being carried with a high hand, and if a stop is not put on him, this city will suffer more in the future than it has in the past. He does not care how much the interests of the majority are injured as long as his own do not suffer. To-day he controls every department in this city. The way he has run them is shown by the high taxes and empty houses. People are being driven from the city because they cannot get work. The manufacturers who employed them have been forced away by the high taxes. The only way to redeem Troy from certain ruin is to depose the men who do the czar's bidding. No help need be expected from his tools. A citizen's party is what is needed. Let all who are in favor of saving their property join in the movement and oust from power this octopus, whose tentacles are on all branches of the city's government."

The Printing Office Towel.

When I think of the towel, the old-fashioned towel, that used to hang up by the printing house door, I think that nobody, in these days of shoddy, can hammer out iron to wear as it wore. The tramp who abused it, the devil who used it, the comp. who got it when these two were gone; the make-up and foreman, the editor, poor man, each rubbed some grime off while they put a heap on. In, over and under, 'twas blacker than thunder, 'twas harder than poverty, rougher than sin; from the roller suspended, it never was bended, and it flapped on the wall like a banner of tin, It grew thicker and rougher, and harder and tougher, and daily put on a more inkier hue; until one windy morning, without any warning, it fell on the floor and was broken in two.—*Burdette.*

Officers Elected.

The Hudson River Telephone Company held its annual meeting last week, and elected the following named officers:

Directors, Jno. E. Hudson, C. J. French, Theo. N. Vail, David B. Parker, W. H. Eckert, James Bigler, A. B. Uline, H. L. Storke, Jos. P. Davis.

President, Jos. P. Davis.

Vice-president, A. B. Uline.

Secretary and treasurer, H. L. Storke.

General manager, A. B. Uline.

Executive committee, Jos. P. Davis, David B. Parker, H. L. Storke.

There is a rumor that electricity will be used as a motive power for the canal boats between Lowell and Boston, if permission is secured from the legislature to construct the same.

The Erie, Pa., Telephone Exchange was established in 1879, and in 1883 that place became a part of the system of the New York and Pennsylvania Telephone and Telegraph Company. Erie has about 430 instruments, and is connected with Buffalo, Jamestown, Warren, Corry, Dunkirk, and other important surrounding places, besides the local villages of the county.

KINDRED INTERESTS

The American Electrical Works, Providence, is one of the busiest electric wire and cable manufacturing companies in the country. The high quality of goods sent out is always kept up, and is a potent reason for the company's popularity. Mr. P. C. Ackerman, in charge of the New York office, in the "Telephone Building," has built up a fine business in this section, and has recently been compelled to secure additional office facilities.

F. B. Aspinwall, 112 Liberty street, New York, has just installed a Hoffman damper regulator for the Jersey City Electric Light Company. The Burlington, N. J., Electric Light Company and the Edison Illuminating Company, of Lebanon, Pa., have each purchased a Lyman & Warren improved steam exhaust pipe head, for which Mr. Aspinwall is agent. The ready sale of both these devices attests their great practicability and popularity.

The New York Electrical Manufacturing Company is the title of a new organization formed for the purpose of manufacturing the Barriett motor and dynamo and general electrical supplies. The offices are in the Western Union building, in Twenty-third street, and the factory at 154 and 156 West Twenty-seventh street. All the gentlemen interested in this company have had long experience in the electrical field. Augustus Noll is the general manager.

The Aluminum Brass and Bronze Company has moved its New York headquarters to the Stewart building, No. 53 Chambers street, and has secured a suite of as well lighted and convenient offices as could be desired. This company has one of the finest and most modern rolling mills in the country, located at Bridgeport, Conn., and is manufacturing the Cowles aluminum and silicon alloys in ingots, sheets, rods, wire and castings, and is also making a specialty of the silicon bronze wire, which is attracting a good deal of attention in electrical circles. Mr. Thos. L. Fowler is general manager of the New York office, and is assisted by Mr. Samuel B. Hawley, agent, and Mr. Frank G. Stone, all of these gentlemen being well known in the electrical field.

The Meter System.—The method of furnishing electric light on the meter system is daily becoming more and more recognized as the only equitable manner of supplying the electric current. This is a tact which is now as readily acknowledged by the consumer as by the electric light companies. The former appreciates the meter because he knows he only pays for what he uses, and the companies are equally confident because the meter assures them a fair return for their invested capital. In view of this, it is not to be wondered at that the sale of meters for registering the electric current is constantly increasing. The Shallenberger meter, owned and manufactured by the Westinghouse Electric Company, Pittsburgh, Pa., has met with extraordinary success. The company has already made over 17,000 meters, of which number 16,000 are in actual daily operation, while the balance are contracted for. The meter is a purely mechanical contrivance, and its workings are perfectly accurate.

Good Insulation Indispensable.—The Pittsburgh *Leader*, in a recent issue, sounds a loud and timely note of warning on the dangers of fire and accidents arising from the careless workmanship and poor quality of wire being used in the wiring of public buildings and private residences. It states that in a number of buildings so wired in Pittsburgh, it has been found necessary to warn the owners not to have the current turned on for fear of an accident that might result in the loss of life. This is a most deplorable state of affairs truly, when it is remembered that there are safe wires available. As regards this part of the question, the *Leader* prints a lengthy interview with Mr. George O. Morse, of the Morse Supply and Construction Company, Pittsburgh, from which we quote the following remarks:

"Time alone will develop the fraud that has been practiced in this city by so-called electricians. Poor workmanship is exceedingly dangerous, especially in electrical appliances and methods. But far worse is the material that is being put into the houses. One might as safely put a red-hot coal in a pile of shavings and expect it to be safe, as the wire that is used in one out of every three houses that have been wired in this city. A house wired properly means the perfect insulation of the wire.

"This so-called weather and fire-proof wire, which has been pronounced safe by the board of underwriters, is nothing but the bare copper wire wrapped with cotton, then covered with a poor braid, and finally soaked in coal tar. It is far from being fire-proof, for it will burn almost as readily as a match, even when it is new. When it is dried out it is as ignitable as a tinder box. This is the quality of wire that is used by a number of the construction companies, and has been put in two-thirds of the buildings that use electricity in this city. * * * It costs only about one-third as much as Okonite, and the profits from wiring a house with such a material is fully twice as large, so one can readily understand why it is used so extensively. It is made of a poor grade of copper, and the insulation is so poor that the covering pulls off easily, leaving the wire bare. This is how so many houses have grounded wires. The moment the wires come in contact with each other, or with a gas pipe, they ignite and the fire flies. The covering on the wire takes fire readily, and, if close to any inflammable material, there is bound to be a conflagration. * * *

"The people themselves, however, are largely to blame, for they will not pay the price for good work. A customer will come in and ask for an estimate for wiring a house in first-class style. Basing the figures on genuine Okonite, we furnish the price. It is expensive, because the wire costs from three to eight cents a foot. They will tell you they can get the work done for one-half from another electrician. The result is that no electrician can remain in the business in this city and do first-class work. I have seen bids for wiring houses, that called for Okonite wire, that the price was not sufficient to pay for the bare wire. * * * Not only are dangers increased from using cheap wire, but the light obtained is of a very poor quality. I can wire a house with Okonite and another with so-called fire-proof wire, and the difference in the quality of light will be as great as between 10 and 25 candle-power light. The cause for this is that when the insulation is poor the wire sort of sweats, and part of the force of the current escapes. With Okonite, the wire is first insulated with tin, then a heavy coating of pure rubber, and on the outside of this, not as an insulator, but as a protection to the insulator, a heavy and closely woven covering of braided cotton. The wire is not fire-proof, nor is any wire such.

* * * * * * * * *

"I have until the last month refused to wire any building except with Okonite, but I had to fall in line with the others or give up the business. I could not begin to compete with those who used an inferior quality or an imitation of Okonite. For over six months I have been carrying as dead stock several hundred dollars worth of Okonite. The people would not pay the price, and I could not use it. I now use the underwriters', but before beginning the contract I inform the owner of the building that I will not guarantee the work in any particular. If they are satisfied to take the risk, all right; if not, some one else gets the job. The Westinghouse companies manufacture their own wire, yet I venture the assertion that Mr. Westinghouse himself has his own house wired with genuine Okonite. A man that thoroughly understands electricity would have no other."

Just as long as the people allow the difference in cost between a cheap and a good wire to influence their selection when wiring is to be done, just so long will we continue to hear of "The Deadly Wire." A good article at a fair price is far cheaper than a poor article at any price.

WANTED by one of the largest firms of **Manufacturing Electricians in Great Britain,** particulars and details of **First-Class Ammeters and Voltmeters** of which they are desirous of taking up the manufacture in England on a royalty, or as may be otherwise arranged. The instruments offered must be of exceptional quality and design.

Reply to **X. Y.,** care of **W. M. WILLS, 151 Cannon Street, London, England.**

A CARD from the Automatic Switch Company, of Baltimore.

TO THE EDITOR OF ELECTRICAL REVIEW:

MY DEAR SIR: In your issue of February 15th, we notice an article headed "Doyle's Motor Switch," which is descriptive of an Automatic Motor Starting Switch, the invention of Mr. Charles B. Doyle, of Chicago. Please be kind enough to inform your subscribers that the claims and objects of this Switch are covered by letters patent of the United States, issued to G. H. Whittingham, in January, 1889, and January, 1890, and now owned by this Company, and that the use of the said "Doyle Motor Switch" will render them liable to suit for damages. The inventor, Mr. Doyle, doubtless does not know of our patents. We invite an investigation on his part, and will afford him all necessary information if he will place himself in communication with us.

We would not thus encroach upon your time and space, but believe it a duty we owe to your subscribers and Mr. Doyle, as well as ourselves. Very respectfully, etc.,

AUTOMATIC SWITCH CO.,
WM. T. MORGAN, Sec. and Treas.
Baltimore, Md., Feb. 25, 1890.

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Correspondence addressed to "ELECTRIC," care of Editor ELECTRICAL REVIEW, will receive prompt attention.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON MARCH 4, 1889.

422,419 Armature; Chas. D. Jenney, Indianapolis, Ind.

422,438 Automatic switch for regulating the power of electric batteries; Geo. B. Pennock, Brooklyn, N. Y.

422,445 Supporting frame for electric railway motors; Edward S. Priest, Lynn, Mass.

422,446 Arc lamp; Geo. C. Pyle, Indianapolis, Ind., assignor to the National Electric Head-Light Company, same place.

422,456 Carbon for electric lamps; Walter F. Smith, Philadelphia, Pa., assignor to the United Electric Improvement Company, Gloucester City, N. J.

422,457 Treatment of storage battery plates; Charles Sorley, New York, N. Y., assignor to the Anglo-American Electric Light Manufacturing Company, of West Virginia.

422,505 Secondary battery; Stanley C. C. Currie, Philadelphia, Pa., assignor to the United Gas Improvement Company, same place.

422,511 Dynamo electric machine. 422,512 Electro-magnet; Rudolf Eickemeyer, Yonkers, N. Y.

422,524 Automatic circuit breaker; Marion C. Happoldt, Providence, R. I.

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422,550 Compound insulating layer for electric coils; Elihu Thomson, Lynn, Mass.

422,556 Electric motor; Henry E. Walter, Schenectady, N. Y.

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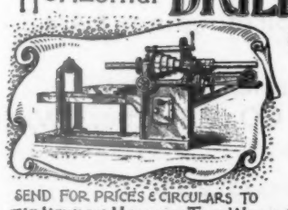

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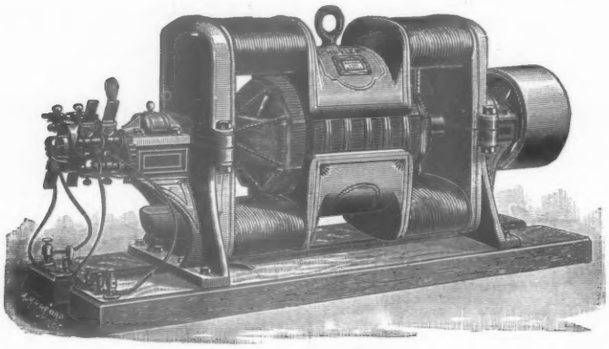

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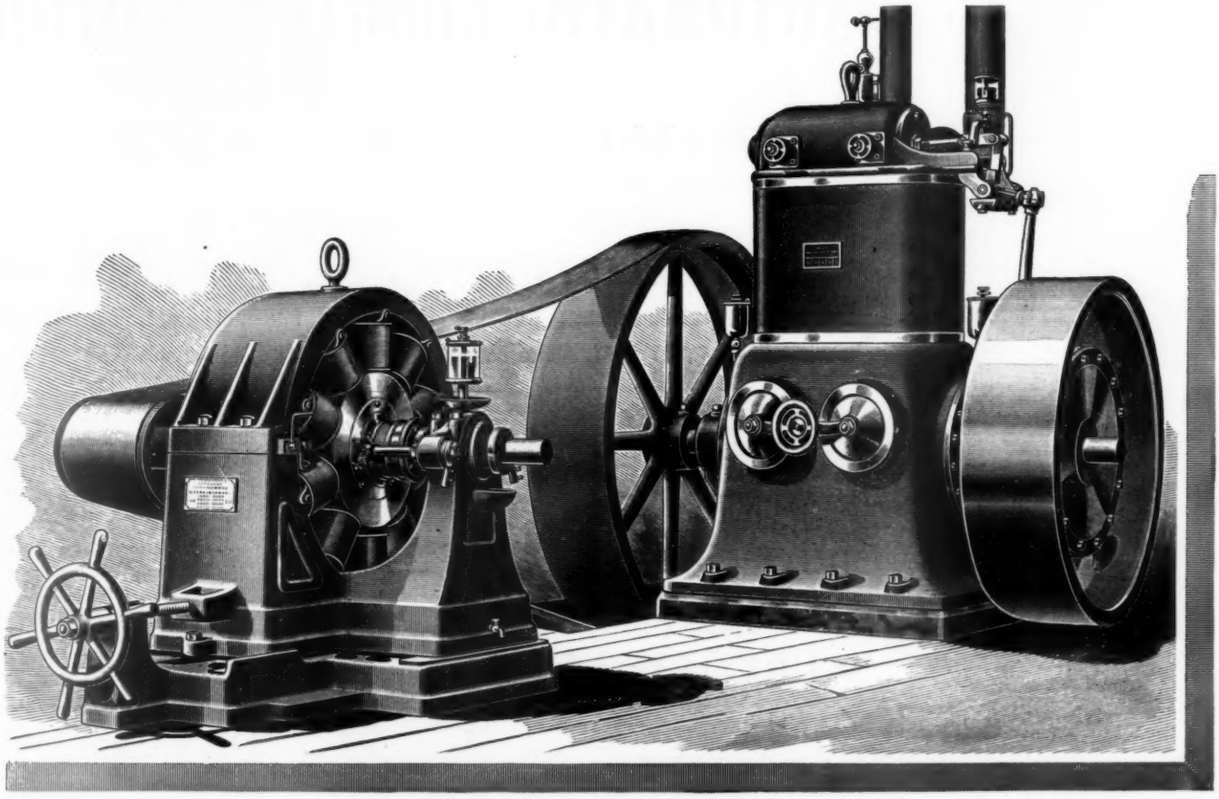

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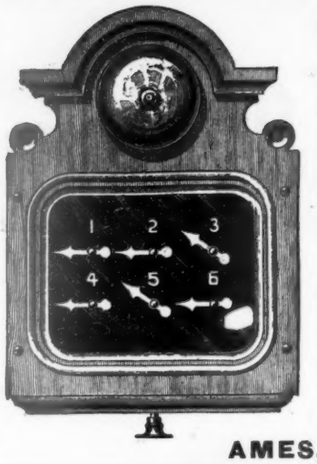

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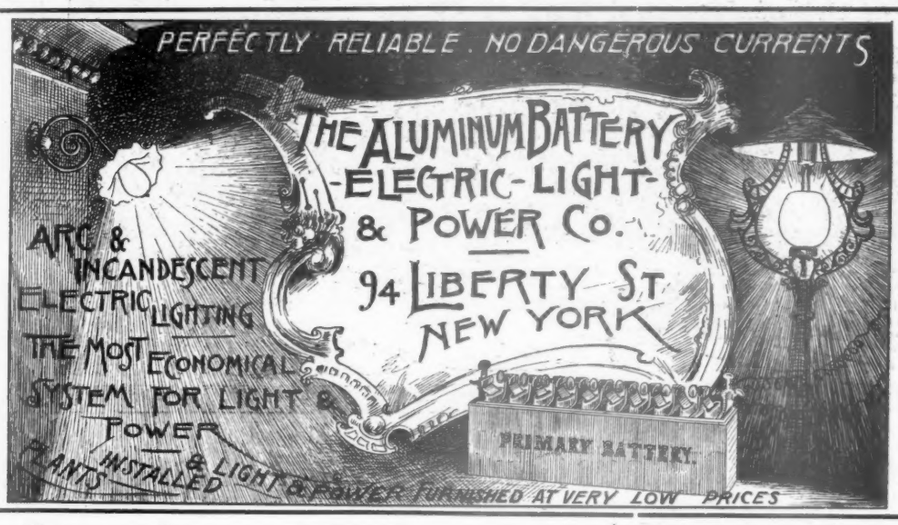
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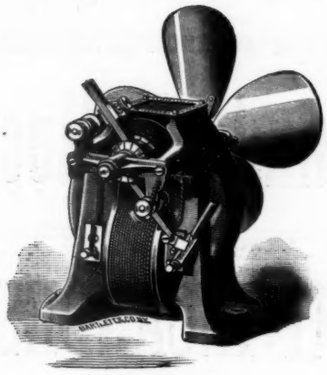

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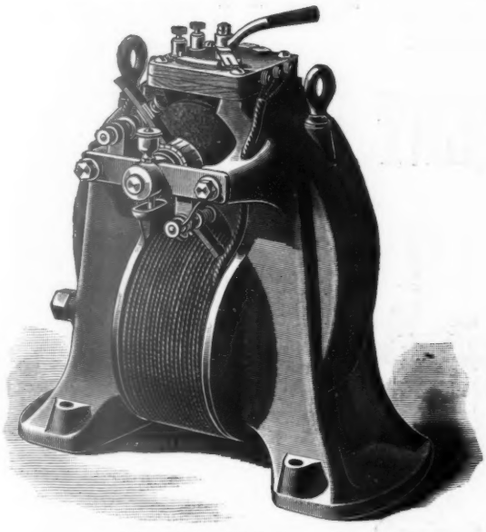

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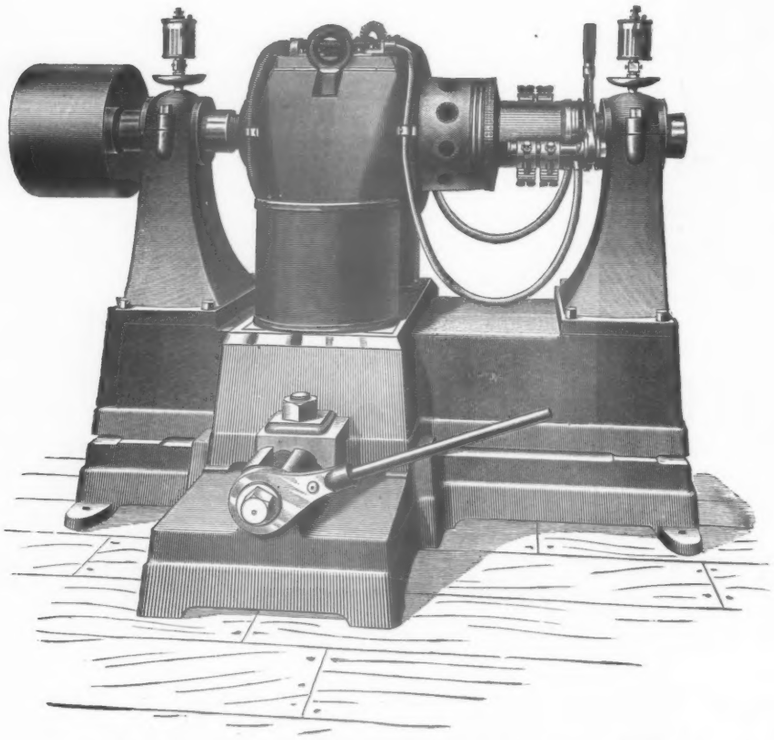

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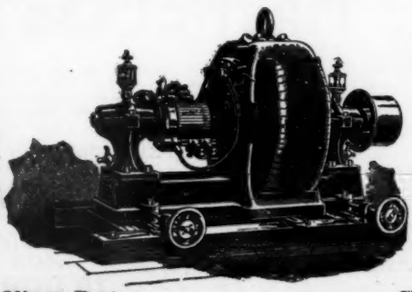

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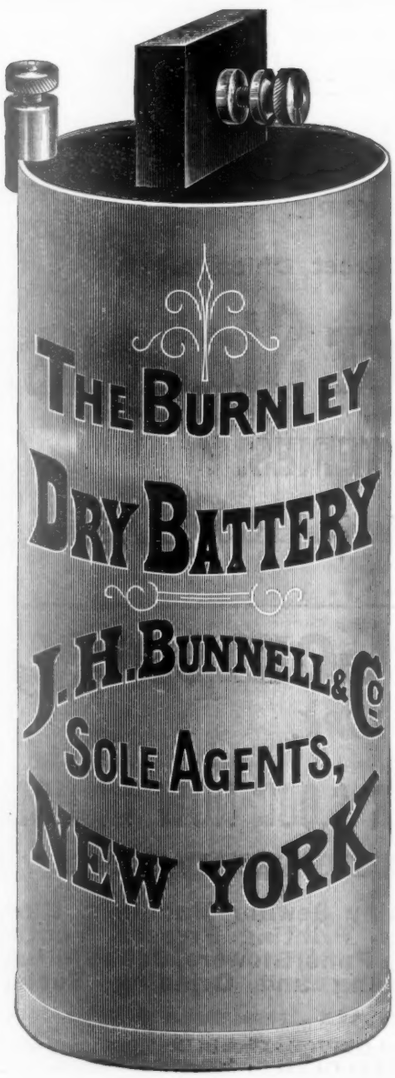

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C	8	.....	.....	.....	6.5	1¼	5,000 FEET PER MINUTE.	530
C	.....	10	.....	.....	6.8	1¼		530
E	.....	.....	.....	25	8.0	2		530
E	16	.....	.....	.....	12.0	2⅜		780
E	.....	20	.....	.....	12.5	2⅜		780
E	.....	.....	26	.....	13.0	2⅜		780
E	20	.....	.....	.....	15.0	3		990
E	.....	25	.....	.....	15.6	3		990
E	.....	.....	32	.....	15.0	3		990
G	.....	.....	.....	50	16.0	3		990
G	28	.....	.....	.....	21.0	4½		1,360

Ball Electric Light Co.
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Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,600 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in Inches.	Belt Speed Required.	Weight of Dynamo.
G	.....	35	.....	.....	21.0	4	5,000 FEET PER MINUTE.	1,360
G	.....	.....	45	.....	21.0	4		1,360
H	.....	.....	.....	70	21.0	4½		1,360
H	40	.....	.....	.....	29.7	6		1,750
I	.....	50	.....	.....	30.0	6		1,750
I	52	.....	64	.....	29.5	6		1,750
J	.....	65	.....	.....	38.0	8		2,290
J	64	.....	83	.....	38.6	8		2,290
K	.....	80	.....	.....	38.0	8		2,290
K	75	.....	.....	.....	46.5	10		2,770
K	.....	.....	.....	.....	47.1	10		2,770
K	.....	.....	.....	.....	52.5	12		3,300

THE NATIONAL CARBON CO.

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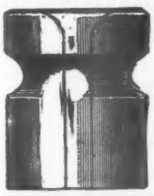
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THE
American Bell Telephone Company,
95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30, 1877, No. 186,787.

The Transmission of Speech by all known forms of ELECTRIC SPEAKING TELEPHONES infringes the right secured to this Company by the above patents, and renders each individual user of telephones, not furnished by it or its licensees, responsible for such unlawful use, and all the consequences thereof and liable to suit therefor.

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427 to 433 North Broad St.
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CORRESPONDENCE SOLICITED.

MINNEAPOLIS. ST. PAUL. ST. LOUIS.

Three more large cities fall into line. All the lines in Minneapolis and St. Paul and between those two cities, comprising 200 miles of track, are to be equipped on the Sprague Electric System.

(STATEMENT OF MR. THOS. LOWREY, PREST. OF THE MINNEAPOLIS STREET RAILWAY.)

"NEW YORK, February 19th, 1890.

"I have to-day closed contract with Sprague Electric Railway and Motor Company for the electrical equipment of the street railways in Minneapolis and St. Paul and between these two cities.

(Signed,) "THOS. LOWREY, President."

St. Louis follows with an order for 68 car equipments for the Lindell Street Railway in that city.

Total number of street railway motors contracted for since January 1st, 1890, 810.

SPRAGUE ELECTRIC RAILWAY AND MOTOR CO.,
Rialto Building, Chicago, 16 and 18 Broad Street, NEW YORK.
AND ALL COMMERCIAL CENTERS.

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WILLIAM HOCHHAUSEN, ELECTRICIAN.

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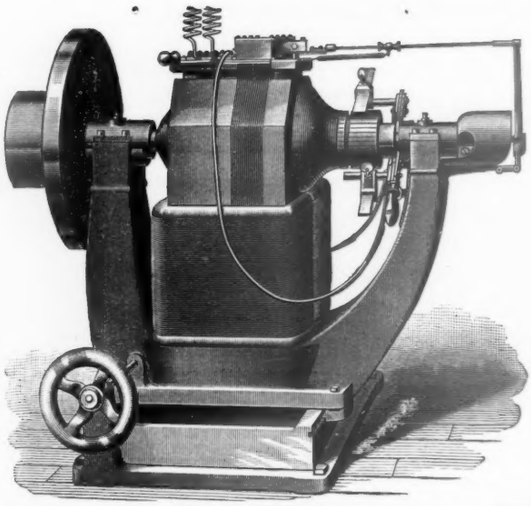

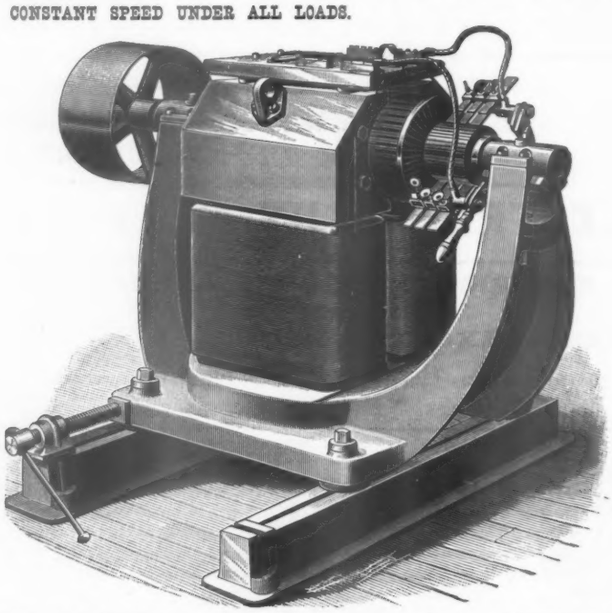

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Underwriters' Copper Electric Light Line Wire, handsomely finished, highest conductivity. Copper Magnet Wire, Flexible Silk, Cotton and Worsted Cords for Incandescent Lighting. Round and Flat Copper Bars for Station Work. Insulated Iron Pressure Wire.

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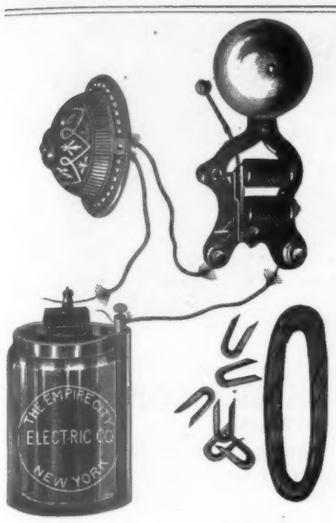
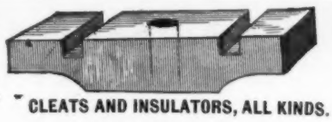


LINEMEN'S TOOLS.



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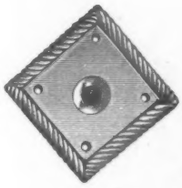

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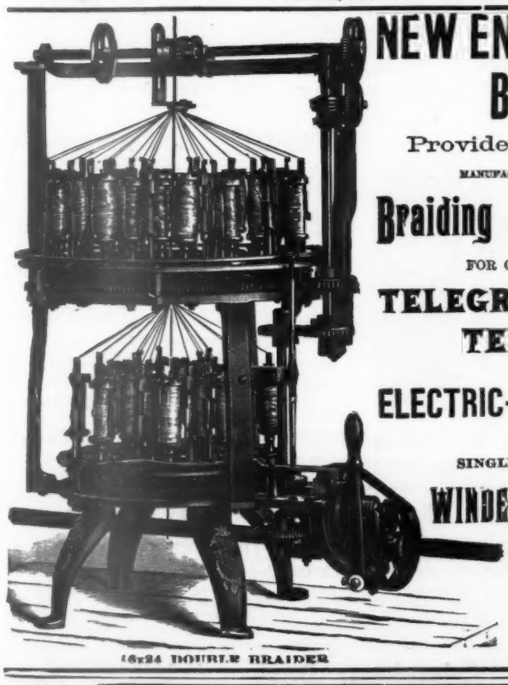

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Underground Arc Light Wires in New York.

The line in 125th Street, 2,000 feet in length, is laid in the small ducts of the Johnstone system of conduits. The cable is a ***BISHOP GUTTA PERCHA WHITE CORE,*** and was laid immediately after the order for the work was given. The cable was connected to overhead arc light wires by running it up in a two-inch iron pipe fastened to the outside of an ordinary city electric lamp post. Connections were made with lights in front of stores by carrying the cable from the ducts in iron pipes under the sidewalk and up the front of the stores. This line has been in continuous use for two months, carrying a pressure of 2,500 volts, and it shows an actual rise in insulation with age and use, as will be seen from the following tests:

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All our White Core India Rubber Insulation is Same Quality as on above cables.

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A New and Improved Method of Fitting Buildings with Insulated Tube Conduits to receive Wire for any Electrical System,

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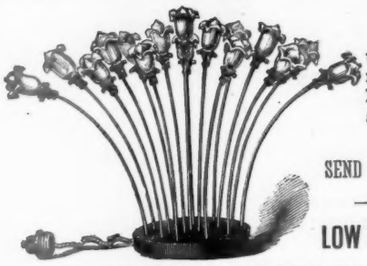

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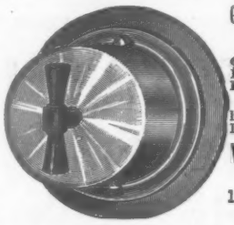

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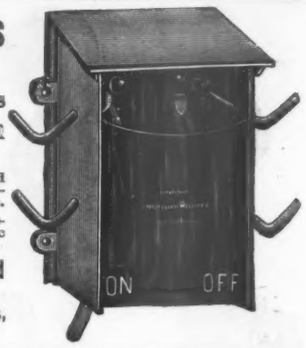

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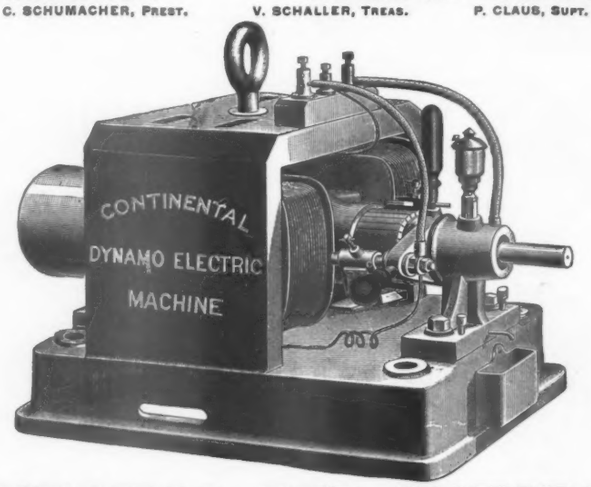

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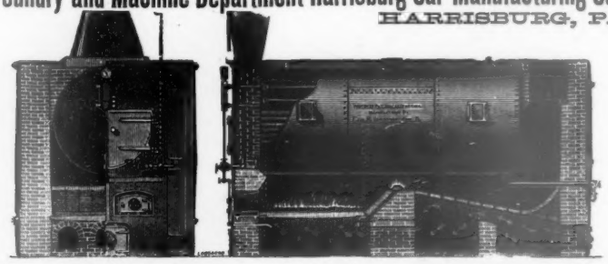

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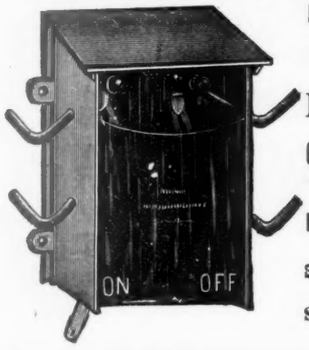

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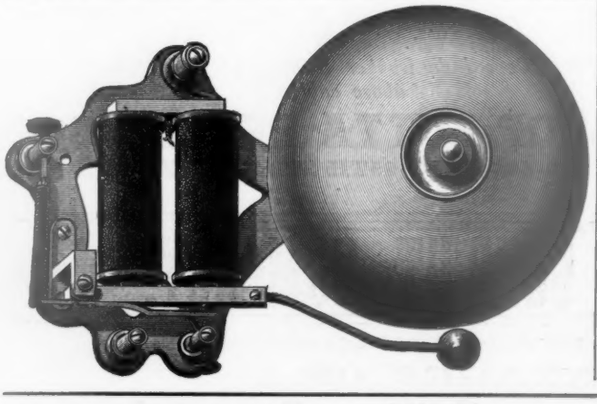

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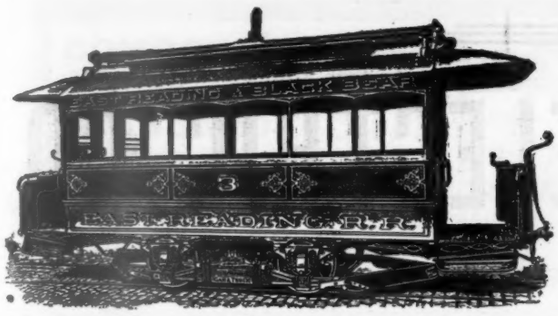

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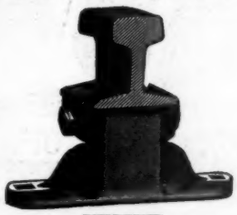

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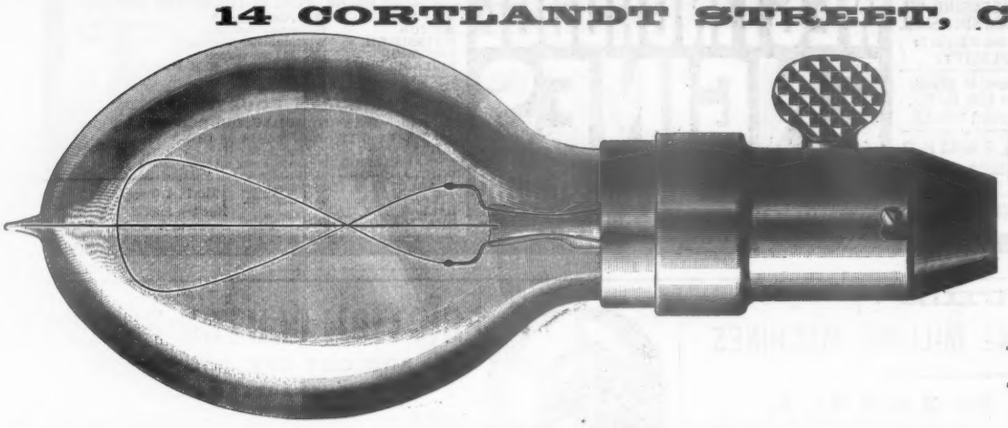

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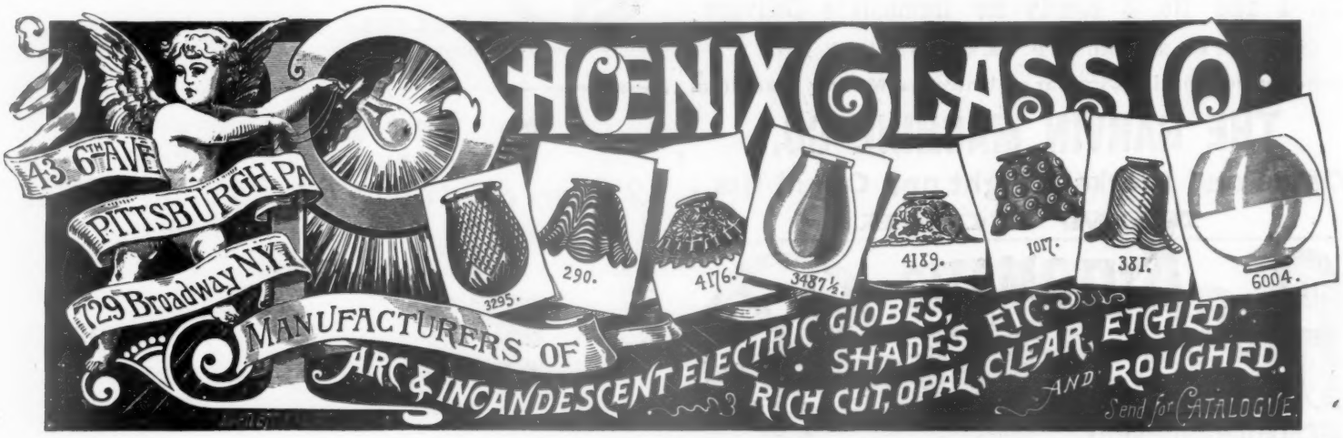

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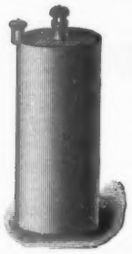

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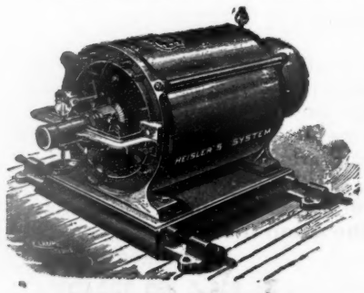

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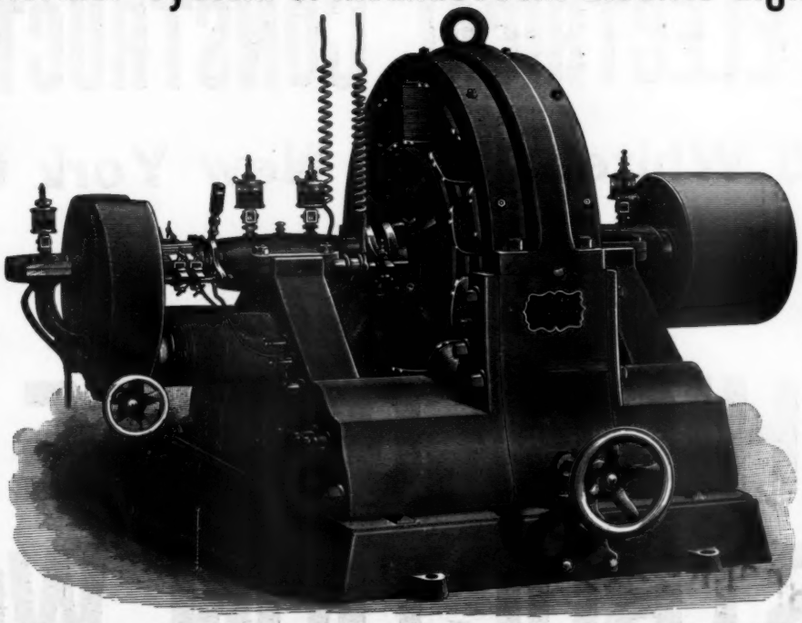

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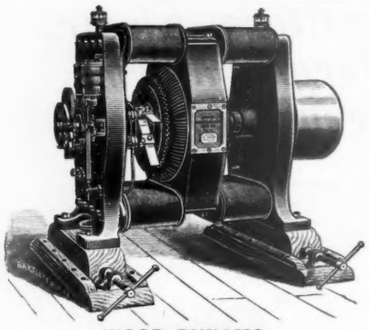

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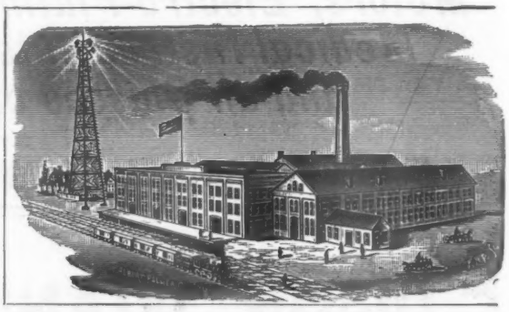

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